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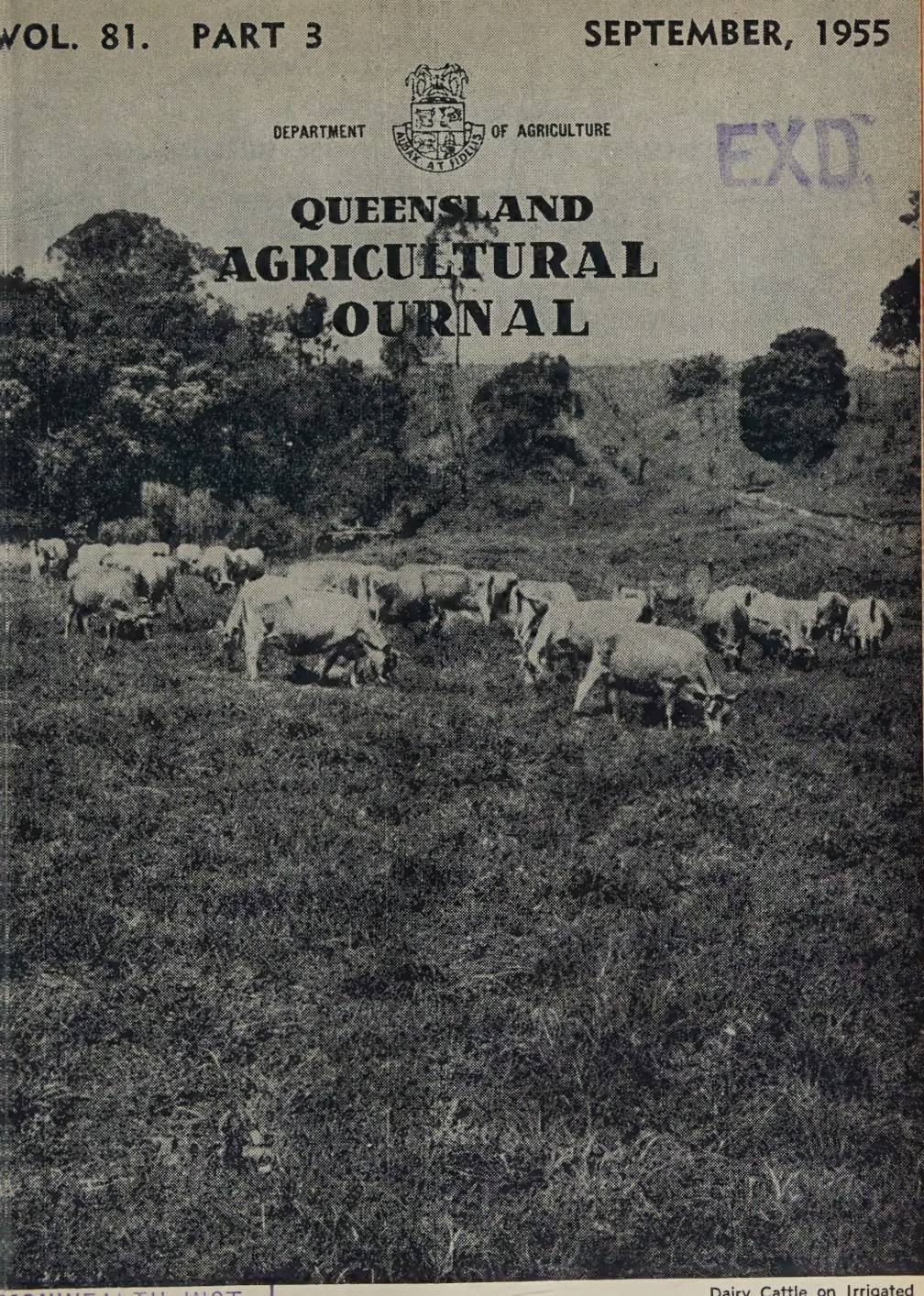
DEPARTMENT OF AGRICULTURE

EXD.

QUEENSLAND AGRICULTURAL JOURNAL



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Tobacco Leaf Grading
Fig Growing
Sawfly Poisoning
Length of Lactation in Cows
Pumpkin Price Survey
Strip Cropping
Nosema Disease of Bees
Feeding Sheep
Farm Refrigeration

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(A list of extension services in southern Queensland will appear in our next issue.)

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The "Queensland Agricultural Journal" is available to Queensland primary producers whose main source of income is the land, to schools and to students for one shilling a year (12 issues). The charge to others is ten shillings a year.

Queensland Agricultural Journal

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Tuberculosis-Free Cattle Herds.

TESTED HERDS (As at 12th August, 1955).

The Tuberculosis-free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements. The studs listed here have fulfilled the conditions to the date shown above.

Breed.	Owner's Name and Address.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus" Stud, Greenmount
	H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy
	Sullivan Bros., "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," Greenmount
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
	W. D. Davis, "Wamba" Stud, Chinchilla
	Queensland Agricultural High School and College, Lawes
	C. K. Roche, Freestone, Warwick
	Mrs K. Henry, Greenmount
	D. B. Green, Deloraine Stud, Durong, Proston
	E. Evans, Wootha, Maleny
	T. L. and L. M. J. Cox, "Seafield Farm," Wallumbilla
	J. Crookey, "Arolla A.I.S. Stud" Fairview, Allora
	M. F. Power, "Barfield," Kapaldo
	A. H. Webster, "Millievale," Derrymore
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
	G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
	T. F. Dunn, Alanbank, Gleneagle
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
	D. J. Pender, "Camelot," Lytton road, Lindum
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
	A. C. Swendson, Coolabunia, Box 26, Kingaroy
	C. Scott, "Coralgrae," Din Din road, Nanango
	R. J. Wissemann, "Robnea," Headington Hill, Clifton
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount
	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, "Ryecombe," Ravensbourne
	Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
	D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
	J. W. Carpenter, Flagstone Creek, Helidon
	H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
	W. S. Kirby, Tinana, Maryborough
	S. A. Crarib, "Trecarne Stud," Lockyer
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	J. A. & E. E. Smith, "Heatherlea" Jersey Stud, Chinchilla
	W. C. M. Birt, "Pine Hill" Jersey Stud, Gundiah
Polled Hereford ..	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla
	D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick
	E. W. G. McCamley, Eulogie Park, Dululu
	Wilson and McDouall, Calliope Station, Calliope

The 1955 Tobacco Leaf Grading Schools.

By V. J. WAGNER, Senior Agronomist, Agriculture Branch.

The importance of correct grading of tobacco leaf cannot be over-stressed. Everyone associated with tobacco growing is fully aware that successful consistent production of good quality leaf is accomplished only by continuous care and attention to detail at all stages.

This care begins in the seedbed to ensure healthy robust seedlings for transplanting. In the field, attention to soil preparation, irrigation, fertilizer application, general crop management, and field hygiene makes possible the production of a high yielding, well-grown tobacco crop. Careful harvesting of mature leaf and close attention to curing complete the production phase.

But the need for care and attention to detail does not end here. The neatly stacked bulks have to be graded and baled for market. Tobacco leaves vary in smoking quality depending on their position on the plant and should be graded accordingly. Manufacturers require certain types of leaf to produce their particular blends. When they buy the type of leaf they need, they obviously want each bale to contain only that type. Mixed bales of different types exclude the competition of some buyers, since they may be interested in only one of the types found in the bale.

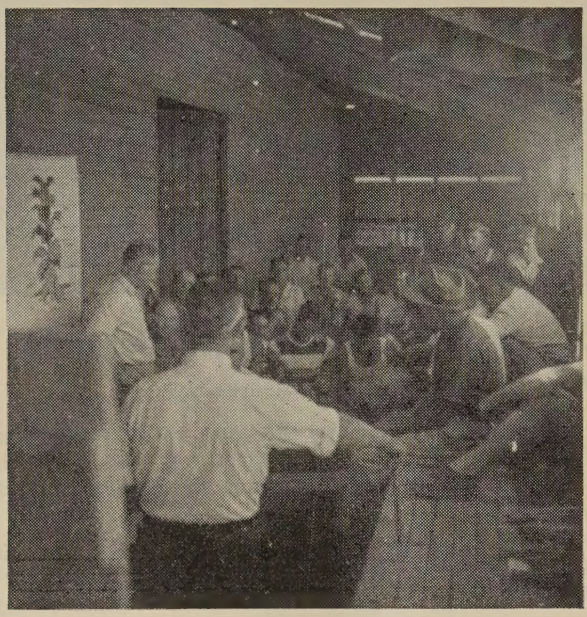
Correct grading of leaf into types and grades allows the farmer to assess his crop more accurately. It also allows the buyer to see the particular type and quality of leaf in each bale, and assists in the accurate appraisal of the lot.

Like most agricultural commodities, tobacco leaf sells to a certain extent on its appearance. Proper presentation on the display floor is therefore essential if the tobacco grower is to obtain full value for his leaf. Correct tying and baling ensure that the leaf appears at its best.

In order to put before tobacco growers the methods of grading and presentation of leaf approved by manufacturers and growers' organizations, grading schools were arranged by the Department of Agriculture and Stock in consultation with representatives of these bodies.

In North Queensland, grading schools were held at Clare (Jan. 20), Mareeba (Jan. 25) and Dimbulah (Jan. 27). In south-western Queensland, schools were held at Yelarbon (Apr. 14), Glenarbon (Apr. 15) and Inglewood (Apr. 16).

Attendance at the various schools generally was good and growers were enthusiastic in their reception of the suggestions offered. Over the years similar advice had been given by field officers of manufacturing companies, notably The British Australasian Tobacco Co. Pty. Ltd., and the Department of Agriculture and Stock, and a number of experienced growers had



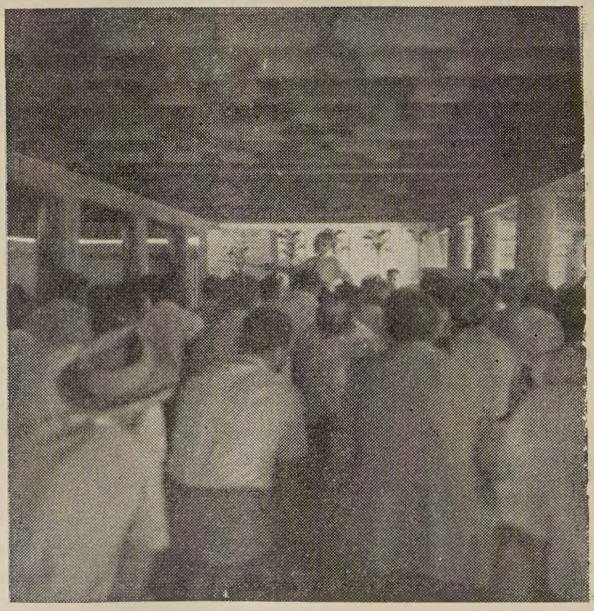


Plate 1.

Interested Growers in Attendance at the Grading Schools. The top photo shows a session in progress at Glenarbon Estates, and in the bottom photo growers from the Inglewood district are "paying attention" to the lecture.

been following the suggestions for some time. The schools served to gather this information and facilitated its presentation as a sequence of desirable procedures in the preparation of the leaf for market.

The following lectures were given at each school:—

(1) Grading of Tobacco Leaf According to Plant Position and Leaf Type.

(2) Grading and Submission of Green Casts and Greens.

(3) The Tobacco Leaf Marketing Board Appraiser's Opinion in Relation to Grading of Tobacco Leaf According to Plant Position and Leaf Type.

(4) Final Presentation of Leaf for Consignment and Market.

The following lecturers participated in these Schools:—

North Queensland Schools.

S. H. Jennings — Representative of The British Australasian Tobacco Co. Pty. Ltd.

H. Hurley — Representative of Godfrey Phillips (Aust.) Pty. Ltd.

A. Smith — Appraiser, Tobacco Leaf Marketing Board.

D. Leinster, S. Soper, A. Boundy — Representatives of North Queensland Tobacco Growers' Co-operative Association Ltd.

South-western Queensland Schools.

H. W. Chaffey — Representative of The British Australasian Tobacco Co. Pty. Ltd.

H. Hurley — Representative of Godfrey Phillips (Aust.) Pty. Ltd.

A. Smith — Appraiser, Tobacco Leaf Marketing Board.

T. Woodcock — Representative of South Queensland Tobacco Growers' Co-operative Association Ltd.

The texts of Lectures 1 and 2 are printed hereunder. Lectures 3 and 4 are domestic matters within the organizations and it is understood the details delivered at all centres are to be included by the growers' organizations in internal circulars to members.

Grading of Tobacco Leaf According to Plant Position and Leaf Type.

The primary reason for the introduction of this system is that smoking quality is largely determined by plant position and manufacturers use tobacco leaf according to smoking quality.

This system divides the leaf produced from the plant into four natural divisions or groups—LUGS, CUTTERS, LEAF, and TIPS (Plate 2). Each group produces a different kind or type of tobacco which in turn is used for different purposes in manufacture. The physical properties and chemical analyses are different and such being the case they should be graded and marketed in their respective groups.

This system of grading and marketing of tobacco leaf according to its plant position and leaf type is practised in other major flue-cured tobacco producing countries and presents no real difficulties to the grower. It facilitates handling and meets market requirements.

Definitions of individual grades of tobacco do not assist a grower in the preparation of his crop for marketing; it is inclined rather to confuse him because of the variation in individual crops. Further, if individual grade definition is relied on alone, growers tend to overlook the most important factor of plant position. However, a brief definition of the kind of leaf produced from the different natural groups will help a grower to decide if it is a LUG, CUTTER, LEAF, or TIP.

(i.) LUGS.—Picked from the bottom portion of the plant. These leaves are normally thin, dry natured,

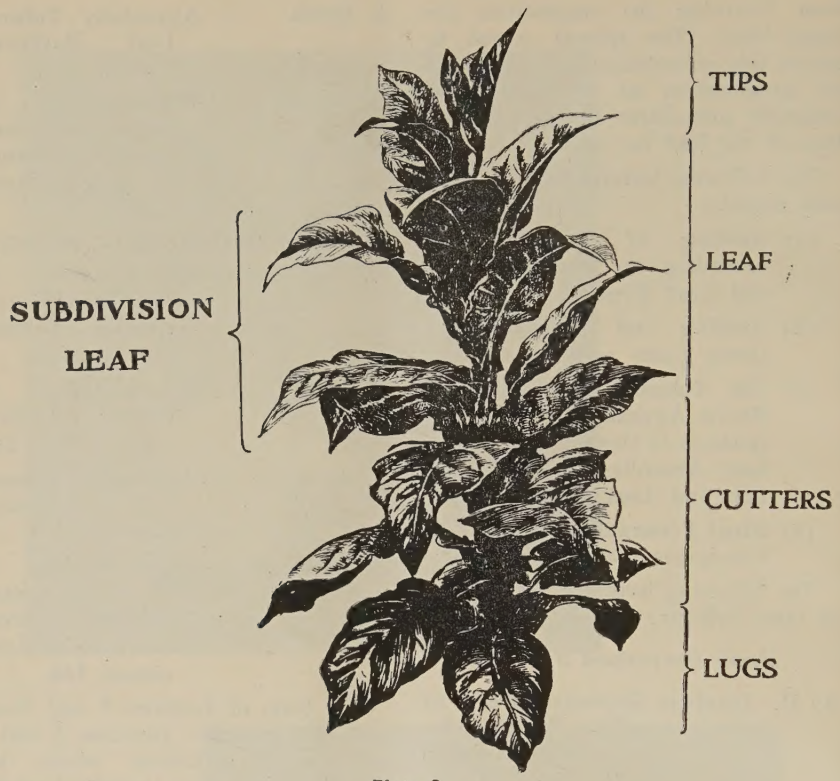


Plate 2.

The Four Plant Position Groups and Types are Delineated Here. The position on the plant from which "Subdivision leaf" may arise is also shown. As indicated in the text these divisions are not sharp, and the groups merge gradually one into the other. Boundaries of leaf groups may also move slightly up and down the plant from the "normal" position shown here.

ripe, and mainly dull in finish. As this group, however, merges with the Cutter group, the highest grade of Lugs can be high in colour. Lugs also usually show a material amount of physical damage of the kind generally to be expected of leaves growing near the ground at the bottom of the plant.

(ii.) CUTTERS.—Picked from the lower-middle and middle portion of the plant. They are thin to medium in body, ripe, and well developed, retaining a lot of natural oil. They usually possess the widest spread of any leaves on the plant, and midribs, although not as fine as in Lug leaf, are finer than in leaves of the Leaf group. Leaves from the Cutter group are soft and silky to handle, are elastic, and possess a high finish or natural shine. Cutters are free from the physical damage associated with Lugs.

(iii.) LEAF.—Picked from the upper middle and top of the plant. Leaves in this group are medium to heavy in body, gummy and waxy, ripe, and of high colour in the best grades, but tending to some slight immaturity and mahogany colour in

EXPLANATION OF PLATE 3.

The Caption "Nature Puts it RIGHT. Make Sure You Do Not Put it WRONG" Aptly Describes this Series of Illustrations. The tobacco plant, with the leaf groups delineated, is shown at the top. The remaining photos illustrate how the mature leaves are picked in the order of lugs, cutters, leaf and tips. Normally each picking consists of leaf from the one group, and keeping each picking separate is of utmost importance in the correct grading of tobacco leaf.

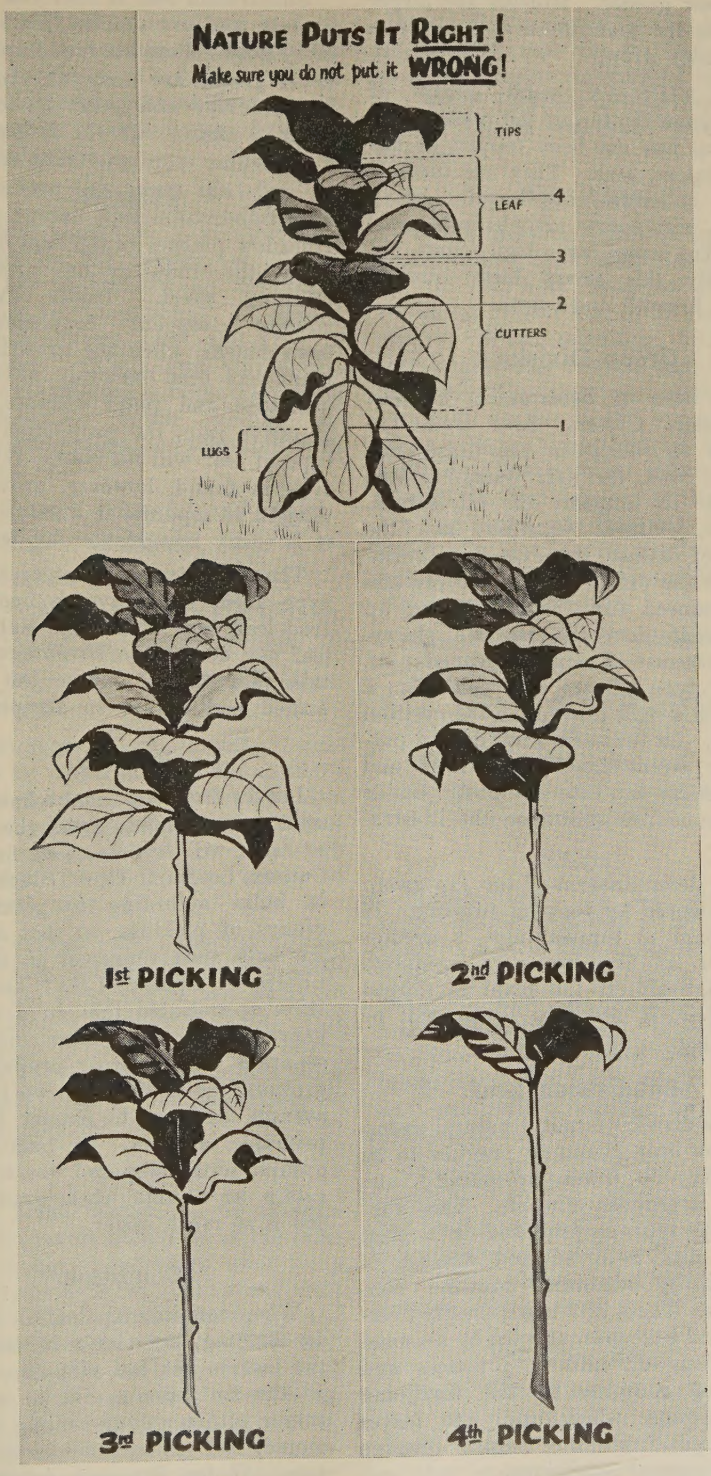

NATURE PUTS IT RIGHT!
Make sure you do not put it WRONG!
TIPS
4
LEAF
3
2
CUTTERS
1
LUGS
1st PICKING
2nd PICKING
3rd PICKING
4th PICKING

Plate 3.

the lower grades. Midribs are larger and heavier than those in leaf from the Cutter group.

(iv.) TIPS.—A small group of leaves from the top of the plant where the crop has not been topped or has been topped high. They are inclined to be immature, are usually heavy bodied, with coarse midribs and veins. Some Tip leaves carry high colour, but generally this group lacks quality, colour, breadth and length.

Group Divisions.

The lines of demarcation between the Lugs, Cutters, Leaf and Tip groups as shown on the illustration cannot, and do not, remain static. Because of influence of soil, season, variety, cultural practices, and the effect of disease, there can be a variation to the extent that Lug types can be produced from a little higher up the plant than the position shown. Also, because of similar circumstances, Cutter type tobacco can come from a position a little lower than the position shown. In the same way, due to particular circumstances, the Leaf and Tip groups can extend slightly outside the boundaries shown on the illustration.

The determination of the Tip group is influenced by topping practice. If the plant is topped high, a greater number of Tip leaves is produced. Alternatively, if the plant is topped low, few, if any, tip leaves will be produced.

Subdivision Leaf.

This division is not a natural group but has been found in practice to be necessary to grade or classify correctly a crop as a whole. This Subdivision type is produced in a crop which has been affected during its growth by abnormal growing conditions. These leaves are usually overripe and have been affected by seasonal conditions or cultural practices and do not conform to the foregoing descriptions, which apply to leaves produced from the natural groups under normal conditions.

Subdivision leaf is thin and lacking in oils and wax. The best grades carry good colour but lack finish. The lower grades are mahogany in colour but are ripe and generally of good smoking quality. It will be found that a particular crop producing true Cutter and Leaf types will produce very little Subdivision leaf, except perhaps from low patches in the field or where some other influence has produced a thinning effect. Under extremely adverse seasonal conditions and environment, when the growth of the plant has been seriously affected by nematode and plant diseases, or by excessive rain, the proportion of this type of leaf will increase. When this type is found, however, growers are advised to separate it when grading—it is easily recognisable by texture.

The advantages of separating this type from the heavy bodied, waxy, true leaf type is because Subdivision leaf can be used to advantage in certain manufacture where the heavier bodied leaf is not so acceptable.

Bulking.

Leaves from a normal tobacco plant commence to ripen from the bottom, so Lugs will be harvested first, then Cutters, Leaf and Tips. Stack tobacco in bulks according to pickings, or groups of pickings, so that stacks in the bulk shed represent in the main LUGS, CUTTERS, LEAF and TIPS. It is appreciated that in a small or uneven crop it is more difficult to separate the groups properly, but growers are advised to work on the average and not to depart from the principle involved. By bulking these groups separately and treating each group as a unit when grading, the job is so much easier.

Condition.

When conditioning leaf in the barn for bulking, care must be taken that the leaf is not too soft nor too dry. If too soft, there will be a loss in colour with a risk of heating and bulk mould, and subsequent serious or total loss. If too dry and pressed down

the leaf will break, resulting in damage to its physical appearance and the making of Scrap. Leaf should always be handled with just sufficient moisture content to enable easy handling without damage.

Grading.

Grading should be preferably carried out by the farmer or directly under his supervision on the farm. The bulk of Lugs should be graded first, then Cutters, Leaf, and Tips, in that order. This allows the longest possible maturation between harvesting and grading. When grading the groups into grades, consideration must be given to—

(1) Texture, ripeness and colour.
(2) Degree of damage.
(3) Degree of trashiness.
(4) Amount of sponge and blemish.
(5) Length and width of leaf.
(6) Degree of Green and Green Cast.

Determination of quality must always be uppermost in the grader's mind and extra care should be taken to avoid putting tobacco of different texture and qualities (even though they might be of similar colour) in the same grade.

The number of individual grades within each group will vary according to the crop. It is not likely to be less than 5 or more than 12. This last figure is to cater for a mixed crop, but if groups have been bulked separately and graded separately it will simplify the task.

Tying.

Tied hands should be of uniform size. Tie leaves should be of the same grade, though it is realised when tying trashy Lugs a better quality leaf must be used. Hands should be firmly and tightly tied so that they will not pull off when samples are being drawn from the bale, will not break when being handled, and will stand up to the treatment received when being reconditioned for storage in manufacturers' stores. Hands should be 1 in. to 1¼ in. in diameter, with the tie leaf coming to a point approximately 1½ in. below the butt. Growers are advised never to use Green ties when tying ripe grades.

Rebulking.

It is a common practice, and it is recommended, that small bins be made up in the bulk shed to facilitate rebulking graded leaf in its respective grades. When rebulking, first check that condition is correct, then "shape" the hands lengthwise, and make a neat firm bulk similar to the practice used when baling. Keep the bulk firm and covered so that weather influences are reduced to a minimum. If the grades are just tossed into these bins they are apt to dry out in dry weather or get too soft in wet weather, and they will bleach and depreciate.

There are several advantages in rebulking grades—

(1) Even condition is maintained.
(2) It facilitates baling.
(3) Less space is required.
(4) It eliminates damaged and bleached samples.

Baling.

"Presentation" is an important factor, so bales should be square and neat. An extra two hands in the corners of the bale occasionally and the use of tie-layers will eliminate untidy and unshapely bales. If the bales are too loosely packed without tie layers they will bend in the middle and considerable damage to the tips will result.

"Condition" must be carefully watched. If the bale is "soft" but considered "safe," avoid overpressing and keep the weight down. If too dry, recondition; otherwise further damage will be done.

Partition Bales.

Where it is necessary to put more than one grade in a bale growers should make a partition using hessian so that the partition runs the full

length of the bale. Grades should be from the same plant position group and as similar as possible. It is recommended that, say, first grade Cutters should be baled with second grade Cutters and not first Cutters with first Leaf, and so on.

If small quantities are left over, make a small bale or fadge. This is done by putting a false side in the press.

Avoid making slack, envelope-type bales, as leaf so baled depreciates considerably due to damage during handling. Some manufacturers are not interested in bales of this type because of the serious damage to leaf occurring in transport.

It is recommended that, when branding either ungraded or graded bales for consignment, the type of tobacco contained in the bale should be clearly marked, using the symbols—

X for LUGS
C for CUTTERS
L for LEAF
T for TIPS.

Grading and Presentation of Green Cast and Green Leaf.

In principle, grading of green cast and green leaf is strictly in accordance with the grading of all leaf produced from the plant; that is, grading is carried out according to the four natural groups known as Lugs, Cutters, Leaf and Tips.

(i.) *Green Cast Leaf* is leaf which shows only slight traces of light green, confined to the veins and midrib of the leaf; no evidence of green should be visible on the lamina portion of either the face or the back of the leaf. This type of leaf usually arises as a result of curing a barn a little too quickly, and must not be confused with fixed greens.

(ii.) *Green Leaf or Fixed Greens* have a harsh, boardy, smooth finish and occur as a result of picking tobacco from the field in an immature state. It is a type of leaf in which, because of immaturity, smoking quality is somewhat impaired; therefore every effort should be made to avoid picking green leaf from the field. It is recognised that it is impossible to harvest a crop and not have a small percentage of green. The market demand for this type of leaf is very small.

In grading green leaf the essential point to remember is that you must keep from your grades leaf which has a harsh, boardy, smooth finish. Green will "run" from a soft, matured leaf, whereas green from a harsh leaf will remain as such for an indefinite period. To assist in defining your soft, matured leaf as opposed to the harsh, boardy, smooth leaf, it is suggested you could bulk your greens from early gradings for a period, then regrade and submit same for sale towards the end of the selling season.

(iii.) *Immature Greens.*—This is a type within itself and this term has been chosen to endeavour to clarify in the minds of growers a leaf which is dark mahogany in colour but which is, however, immature. Leaf of this type has little or no commercial value and arises under circumstances where a crop, as a result of seasonal conditions, late planting or unsuitable soil types, continues to grow vigorously in the field, thus producing delayed maturity. When leaf is picked in this state the usual practice is to endeavour to colour it in the barn over a period of up to 60 or 70 hours. This process will produce a leaf which has had the green colour stewed out of it. Chemically, however, it is a most undesirable smoking leaf. Do not on any account confuse the above mahogany type with your sweet mahogany leaf which comes from a normal, well-matured crop.

Grading.

When grading your green cast or green leaf from any one of the four

natural groups, some factors to take into consideration are:—

(1) Texture and colour.

(2) Degree of damage or trashiness.

(3) Length and width of leaf.

Final Presentation.

Always bale your green grades together, matching them as closely as possible within each group—for example, bright with bright, mahogany with mahogany, long with long, short with short, and damaged with damaged.

Remember! Your job of grading is simplified if you pick your leaf from the field evenly, according to plant position, and bulk the leaf in the order of pickings.

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of ..... seed
Drawn from ..... bags
Representing a total of .....
Purchased from .....
Name and Address of Sender
Date.....

SIZE OF SAMPLE

Barley	8 oz.	Oats	8 oz.
Beans	8 oz.	Peas	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan	4 oz.
Millets	4 oz.	Wheat	8 oz.

Vegetable Seeds - ½ oz.

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A Strip Cropping Project Near Pittsworth.

By J. C. GALLETLY (formerly Assistant Soil Conservationist, Pittsworth).

Too often, people think of soil conservation only in terms of contour banks. While contour banks do assist in the control of erosion by intercepting surplus runoff, they must be supported by other practices which will ensure the stabilisation of the soil and the absorption of the maximum amount of rainfall.

These additional practices include the retention of crop residues on the surface of the soil; maintenance of the ground surface in a rough condi-

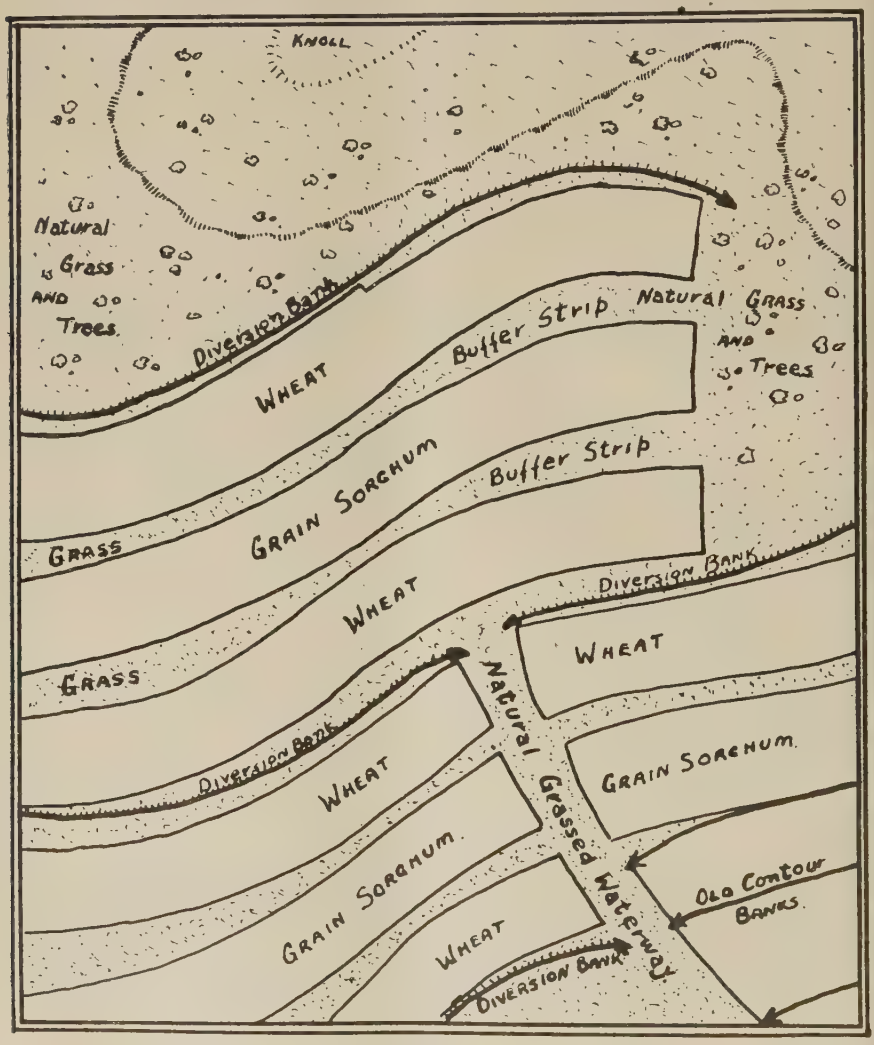

Plate 1.

Outline Plan of Portion of the Strip Cropped Area on Mr. A. G. Muirhead's Property at Pittsworth. This shows clearly the experimental layout of contour cropping strips with grass buffer strips, diversion banks, waterway, etc., on a 7-8% slope. (1 inch = 5 chains.)

tion for as long as possible; and the rotation of crops to ensure the restoration of soil structure and fertility.

The preliminary approach to soil conservation by most farmers involves the installation of contour banks, because deep gullies and silt patches in their cultivation paddocks show that the land is actively eroding and reclamation is an urgent requirement.

On land which is not eroded or on land which is being cultivated for the first time, a system of strip cropping, combined with stubble mulching and crop rotation, may be adopted and the land brought into full production with a lessened erosion potential. By using such a system, erosion losses may be substantially reduced and the construction of contour banks may not be required for some years.

The procedure of alternating different types of crops in contour strips across the land is known as strip cropping. This method is practised in many parts of the U.S.A., but has not found wide application in Queensland, because of the belief that in areas of high seasonal rainfall strip cropping alone may not have much practical value in controlling erosion.

A Pittsworth Project.

On Mr. A. G. Muirhead's property, south of Pittsworth, is a stretch of country with a 7–8% slope, growing native grasses, which he intended to bring into cultivation. Some of this land had been cultivated previously, but owing to the erosion hazard cultivation was discontinued 19 years ago. Mr. Muirhead decided to adopt a system of strip cropping in order to use this land, rather than contour-bank it completely.

The slope is too steep to allow normal cultivation, and, if contour banks were constructed on the land, cultivation would be restricted to single-unit implements, whereas on the rest of the farm multiple units are utilised.

The disadvantages of strip cropping were considered, the main one being that very little is known of its effectiveness in reducing erosion on the Darling Downs. Contouring is fully proven and universally accepted as a sound method of intercepting runoff and so reducing erosion, but strip cropping is still in the experimental stage and remains to be proven.

It was considered that strip cropping alone would not be sufficient to cope with the erosion on the steep land, so it was decided to use strip cropping in combination with occasional diversion banks, and to adopt a rotation that would give the maximum vegetative protection to the ground.

If it is found after five or six years that erosion is accelerating, then either the whole area will be contoured or the whole area will be sown to pasture for a similar period, and this rotation continued. Mr. Muirhead's project may well prove to be valuable experimental work, as he intends to strip crop and use a crop-pasture rotation on the area concerned.

Plate 1 shows the layout of the upper area.

How the Strip Cropping Works.

A diversion bank is surveyed above the stripped area, and the first three cultivated strips are each 50 yards wide. Between these are half-chain "buffer strips" left in native grass. Below the third strip, another diversion bank is surveyed.

The cultivated width mentioned (50 yards) is purely experimental and may have to be reduced later on. This width may be satisfactory for a few years while the soil structure remains good, but as structure and fertility deteriorate, the cultivated strips may be made narrower.

The cropping system to be adopted is as follows. Summer and winter crops will alternate down the slope, and stubble will be left on the ground until the following crop is far enough

advanced to provide protection to the ground. For example, the upper and lower strips were broken up in July 1952, but suitable planting rains did not occur until September 1953, when late wheat was planted. Consequently, the middle strips were not broken up until this crop was well up. These strips would be planted to grain sorghum, and the wheat stubble would be left until this crop was established. The grain sorghum stubble would then be left until the next wheat crop was protecting the ground, and so on.

In February 1954, four inches of rain fell in about an hour over this area, but in spite of this high intensity, very little erosion occurred. A small quantity of silt was washed off the strips in places, but this was caught in the buffer strips of grass and no silt was lost from the overall area.

Plate 2.

An Aerial View of the Strip Cropped Area on Mr. Muirhead's Farm. The strips at the right-hand side of the picture are those indicated in Plate 1. The cultivation in the centre is an area which has been contour-banked for many years.

LEAFLETS ON SOIL CONSERVATION.

The following Advisory Leaflets on soil conservation are available free to Queensland farmers:—

No. 196. Soil Conservation in Queensland. General Aspects.

No. 197. Soil Conservation in Queensland. Vegetation and Water Disposal.

No. 198. Soil Conservation in Queensland. Contouring.

No. 212. Soil Conservation in Queensland. Pondage and Diversion Structures.

No. 213. Soil Conservation in Queensland. The Prevention and Control of Gully Erosion.

The Fig.

By R. L. PREST, Senior Adviser in Horticulture, and A. A. ROSS, Horticulturist.

Fig growing is a comparatively minor industry in Queensland, with some 36 acres under crop producing approximately 10,000 bushels of fruit annually. Commercial production is confined mainly to the Metropolitan area and the bulk of the fruit is used for jam

Plate 1.

Brown Turkey Fig Trees in the Sunnybank District.

making. Very few figs are marketed as fresh fruit, mainly because they deteriorate rapidly in the humid climate of the coast within a short period after harvesting.

The fig (*Ficus carica*, fam. *Moraceae*) is native to the arid, semi-desert areas of Western Asia. The plant (Plate 1) is a broad-leaved deciduous tree which bears numerous small flowers inside a hollow receptacle with an opening (the eye or osteolum) at the distal end. This receptacle later becomes the fruit.

The tree can withstand winter temperatures as low as 15°F. when in a state of dormancy. Young trees are, however, susceptible to frost injury and must be protected during cold weather after they are planted out. High summer temperatures have no adverse effect on the tree provided soil moisture is maintained at a satisfactory level, but the fruit is inclined to be tough and may ripen prematurely. Summer rains may cause the fruit to split as it matures and also increase losses due to moulds.

Deep, fertile clay loam soils are normally preferred for figs, but in Queensland most commercial orchards are located on a light sandy loam and the crop is grown under irrigation. Though the tree is somewhat tolerant of poor drainage, optimum growth and high yields can normally be expected only in a well-drained soil.

VARIETIES.

Fig varieties are classified into four groups known respectively as:—(*a*) *Caprifigs*—primitive types from which commercial varieties have been developed; (*b*) *Smyrna* figs—varieties which are productive only when the flowers are insect pollinated; (*c*) *Common* figs—varieties which bear commercial crops of fruit even when the flowers are not pollinated; and (*d*) *White San Pedro* figs—varieties which exhibit pollination characteristics of both the Smyrna and the Common groups.

Plate 2.

White Adriatic Fig, a Drying Variety of Excellent Quality.

All the figs grown in Queensland belong to the *Common* group, the principal varieties being White Adriatic, Brown Turkey, Brunswick, Cape White, White Genoa and Black Genoa.

White Adriatic, one of the drying figs, is not grown commercially but the variety is popular in home gardens. The main-crop fruit (Plate 2) are medium to large in size, spherical to top-shaped and usually green in colour, though sometimes with a purplish tinge. The pulp is light strawberry to deep red and has an excellent flavour. The crop matures in February and March.

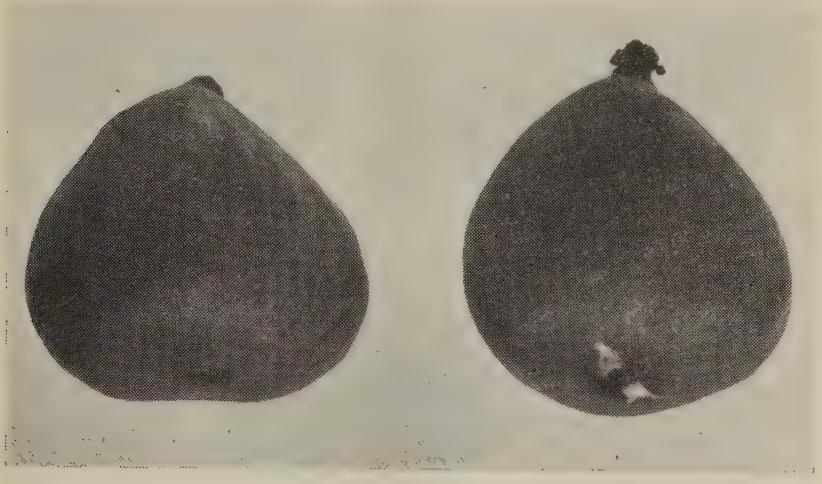

Plate 3.

Brown Turkey Fig, the Main Commercial Variety Grown in Queensland.
The fruit has a purplish skin and pink-brown flesh.

Brown Turkey is the main commercial variety in Queensland. The tree is large and vigorous and crops well under favourable conditions. The fruit (Plate 3) is medium to large in size, pear-shaped with fairly prominent, deeply coloured ribs and a large, open eye; the skin is purplish-brown with lighter shades towards the stem end; the flesh is pinkish-brown with an excellent flavour. Brown Turkey is somewhat susceptible to souring in wet weather. The season is February to April.

Brunswick is a preserving fig known in Texas as *Magnolia.* In Queensland, it is mainly confined to the home garden, where the tree is usually large and vigorous with narrow-lobed leaves. The main-crop fruits are of medium size, spherical to top-shaped, with well-defined ribs. When mature, the fruits are reddish-brown in colour with an amber, seedless pulp which is somewhat coarse-textured and sweet in flavour. In wet weather, the figs have a pronounced tendency to crack as they approach maturity. The fruit ripens during February and March.

Cape White is an introduction from South Australia, where it is used mainly for processing owing to the attractive golden colour of the manufactured jam. The trees are compact and vigorous. The fruit (Plate 4) is small, squat, pear-shaped, almost neckless, slightly ribbed with a small open eye, and yellowish-green in colour with a

darker shading along the ribs when mature. The flesh is creamy-white with a solid centre and numerous white to brownish seeds. Cape White is an early variety which matures its fruit in December and January.

Plate 4.

Cape White Fig, Probably the Best Jam Variety.

White Genoa, though seldom grown commercially, is commonly planted as a garden tree in the cooler coastal areas. The fruit is large with a thick neck, short stalk and medium open eye. The skin is waxen-yellow and the pulp amber, tinged with strawberry.

Black Genoa is a large, purplish-black fig with a reddish flesh. It is commonly grown in home gardens and matures slightly earlier than *Brown Turkey.*

PROPAGATION AND PLANTING.

The fig is normally propagated from cuttings which are selected during the dormant period from well-matured wood of the previous season's growth. Each should be from 8 to 10 inches long, with the basal cut just below a node and the top cut just above a node. They are normally heeled in moist sand in a cool shady place for the winter and remain dormant until early spring, when they are set out in nursery rows spaced 4 feet apart with approximately 1 foot between cuttings. They should be planted with the upper node above ground level.

Nursery attention involves frequent irrigation and the removal of any side shoots which develop. Growth is comparatively rapid and within a year the trees are usually sufficiently forward for planting out in the orchard.

Fig trees are planted when they are dormant at any time between autumn and spring. The roots must be protected when the trees are taken from the nursery to the orchard as they are very susceptible to drying. The trees are planted about 3 inches deeper than they stood in the nursery, planting methods being the same as for other fruit trees. The young tree is headed back at a height of approximately 2 feet and the framework is formed 18 inches or so above the ground.

Tree spacing ranges from 25 to 30 feet according to variety and cultural practices. Where irrigation facilities are available, closer spacing is permissible.

PRUNING.

At the end of the first season's growth, the secondary arms which have developed are shortened back. All suckers and surplus inner branches arising from the main arms should be cut out. Long weak limbs with few or no laterals are shortened back so that the tree will produce a compact and symmetrical head which is neither too dense nor, on the other hand, so open that the main limbs and branches are exposed to the sun in summer (Plate 5). A similar programme should be followed for the next two years.

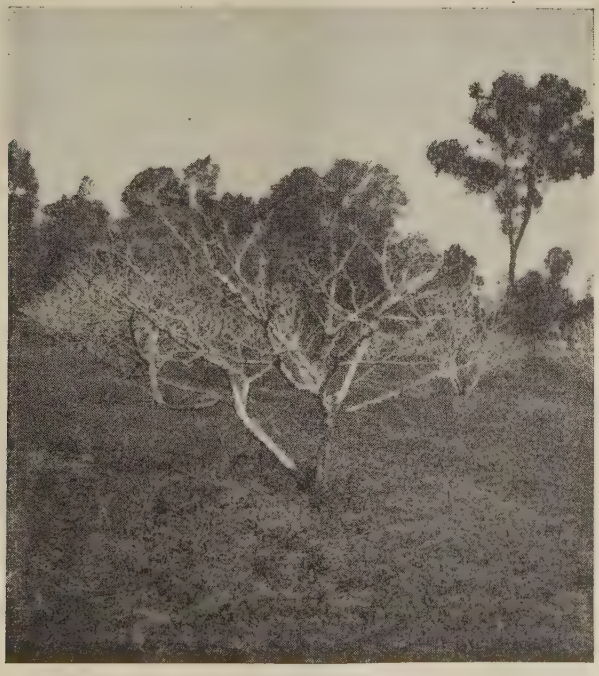

Plate 5.

A Well-Pruned Fig. Note the sturdy frame and symmetrical head.

The fig tree normally bears two crops of fruit each year, the first crop appearing on wood of the previous season's growth and the second or main-crop on new wood of the current season's growth. As the latter crop supplies both the fresh fruit market and the jam trade, moderate to heavy winter pruning is generally practised to force new growth each year.

Decadent trees with a sound framework and a healthy root system may be renovated by heading back to secondary arms within 12 to 18 inches of the primary frame. This treatment produces new growth from which lateral branches can be developed. Trees cut back in this manner are susceptible to sun-scald and the exposed limbs should therefore be protected with a thick coat of whitewash.

SOIL MANAGEMENT.

The soil management programme in the fig orchard is similar to that for other deciduous fruit trees. It should maintain the fertility of the soil and suppress weed growth which might compete with the trees for soil moisture during dry periods. In coastal districts, shallow cultivation is necessary to destroy weeds during the dry spring months. Periodic applications of farmyard manure are desirable. Alternatively, the organic matter in the soil can be maintained by planting a winter cover crop such as New Zealand blue lupins or golden tares in late summer and ploughing it in during early spring.

Fertilizers are invariably used to maintain tree vigour in the light-textured soils on which figs are usually grown commercially. An 8:10:5 or similar mixture has proved satisfactory when applied at the rate of 1 lb. per tree per year of age. Trees which are backward or carrying heavy crops may be given an additional dressing of the same mixture at half this rate when the fruit is slightly more than half developed. Excessive amounts of nitrogen are undesirable, as they tend to promote vegetative growth, delay fruit maturity and produce large fruit which is susceptible to splitting and souring.

The fig tree has a high lime requirement and thrives best in soils which are nearly neutral in reaction. In acid soils, a response to agricultural lime or dolomite can be anticipated. The rate of application will depend on the soil texture and the initial reaction, but 1½ to 2 tons per acre is a normal dressing.

HARVESTING.

Local market requirements usually determine the stage of maturity at which picking should take place. If harvested too green, the fruit carries well but is unpalatable on ripening and makes an inferior jam. If harvested too ripe, it is inclined to "leak" at the eye and develop mould and other transport rots. The fruit is usually pulled from the tree by twisting the neck but it may be cut with a knife or clippers. The juice which exudes from the fruit is irritating to the skin and pickers usually wear gloves.

The trees are picked over several times in order to harvest the fruit in prime condition, the figs being placed in shallow containers and packed in suitable boxes for transport to the factory. The boxes at present in use hold approximately a bushel of fruit, weighing about 56 lb.

For the fresh fruit market, figs are packed in single-layer cardboard boxes 8 inches long, 6 inches wide, and 2 inches deep which hold 12 fruits. For transport these are packed in containers holding from 12 to 16 boxes. A bushel case opened on the side comfortably holds 16 boxes.

The fruit may be allowed to remain on the tree after it matures and be harvested later as dried figs. Those which fall to the ground can be collected and dried on trays in the sun, but they are generally inferior to fruit which remains on the tree until it is thoroughly dry. Fallen fruit must be picked up frequently to prevent spoilage through contact with the soil.

Trees normally produce full crops at seven years of age but some begin bearing at the age of four. Yield varies considerably according to variety and cultural conditions, but a mature *Brown Turkey* fig should produce about five bushels of fruit each year.

PINEAPPLE ADVISORY COMMITTEE.

Flesh colour in pineapple fruits will be investigated in fertilizer trials which were recently established by officers of the Department of Agriculture and Stock at Woombye, Deagon, and Gooburrum. This decision was made at a recent meeting of the Pineapple Advisory Committee held in Brisbane.

The consumer preference for pineapple slices with a rich yellow colour is so pronounced in overseas markets that canneries in Queensland have had to tighten up the standards for fruit arriving at the works.

The causes of poor internal colour in the fruit are not well understood, but soil fertility—in particular the balance between the three major plant nutrients (nitrogen, phosphorus and potash)—may have a bearing on the problem. The fertilizer schedules in the North Coast trials contain varying amounts of each of these nutrients, and the flesh colour of the fruit harvested from the several plots will therefore be of considerable interest to growers.

Reports of severe losses from top rot in autumn plantings of pineapples in southern and central Queensland were also considered by the Committee.

Wet weather during the autumn months hampered land preparation before planting and many crops were established in ground which was thoroughly saturated. Conditions were therefore favourable for infection.

If there is a recurrence of such losses, autumn planting of tops might easily lose much of its popularity. This would be a major setback to the industry, for top plantings simplify plant selection and produce even crops which mature their fruit during the summer months.

The Committee noted that officers of the Department of Agriculture and Stock are, among other things, studying the effects on top rot of soil tilth at the time of planting, methods of curing planting material, and fungicidal treatments. These investigations may lead to a practical solution of the control problem.

Unfruitfulness in Papaws.

By R. L. PREST, Senior Adviser in Horticulture.

In most papaw plantations, the fruit set varies a great deal from plant to plant and from season to season. When it is poor, bare areas occur between fruits or clusters of fruit on the stem and a considerable reduction in yield is recorded.

Such unfruitfulness may be due to a variety of causes, some of which are inherent in the constitution of the individual plant. Frequently, however, poor setting is due to adverse climatic conditions during the flowering period (Plate 1).

Plate 1.

Faulty Setting in Hermaphrodite Strain of Papaw. Note the gaps on the stem where young fruits and flowers have fallen off.

Flower Types.

The papaw is almost unique among cultivated crops in that there are three primary flower types, known respectively as pistillate (female), staminate (male) and hermaphrodite (bisexual).

Female trees normally produce only female flowers. Each of these is borne on a short stalk in the axil of a leaf, but in some strains the stalk may carry subsidiary flowers below the terminal one. The five petals are entirely separate from each other and in the centre of the flower is a pistil with a swollen base—the embryo of the papaw fruit. Stamens are absent from the flowers, which therefore produce no pollen, and fertilisation is dependent on pollen from male or hermaphrodite flowers on adjacent trees.

Male trees are quite distinct from female trees during the flowering season, for the blossom is conspicuous, with long pendant strands carrying innumerable small trumpet-shaped flowers in which the petals are fused together at the base. Each flower contains several stamens—long thread-like structures with swollen tips in which pollen is produced—but the pistil is either absent or rudimentary. Sometimes, a few hermaphrodite flowers are produced on the strands of the blossom and these give rise to the novelty of male trees bearing fruit. Fruits on the male tree, though quite edible, are of little commercial value.

Hermaphrodite trees in blossom are not unlike female trees, for the flowers are borne on short stalks in the axils of the leaves. On close inspection, however, it will be noted that the pistil in the middle of the flower is surrounded by a ring of stamens. The flower structure in hermaphrodite trees is generally more variable than in male and female trees and some of the distinctive blossom types have received names such as *elongata, pentandria* and *intermediate,* which are based on the shape of the fruit when it matures.

Strain Defects.

Lack of stability in the flower type is a characteristic of the papaw plant. Thus, under some conditions a female tree may occasionally produce hermaphrodite and/or male flowers, while a male tree may produce hermaphrodite flowers and an hermaphrodite tree female or male flowers. Where such instability is an inherent character of the strain, it will be passed on to the progeny of the plant. In the absence of selected plant material, therefore, the proportion of sterile flowers tends to increase in successive plantings.

This defect is most pronounced in the hermaphrodite strains, and growers know only too well the ill-effects which follow the propagation of an inferior strain from what was once a promising type of papaw.

Barrenness or unfruitfulness in hermaphrodite papaws can only be avoided if steps are taken to exclude inherently unfruitful strains from commercial plantings. Seed must therefore be obtained from trees with a record of consistent bearing on which controlled pollination has been applied.

Environment.

In southern Queensland, most papaw plantations contain a mixture of female and male trees, the proportion of the latter being about 10%, which is normally sufficient to ensure adequate pollination of the female flowers (Plate 2).

The transfer of pollen from male flowers on one tree to female flowers on another is brought about by air currents. During a fine summer day, the air in a papaw plantation is laden with pollen grains and any female flower which is in a receptive condition will automatically receive its quota of pollen.

There are, however, periods of the year when conditions are either not suitable for the transfer of pollen or unfavourable for fertilisation after pollen has reached the female flower.

In the winter months, for example, temperatures are frequently too low for the production of pollen; female flowers then cease to be receptive before pollen becomes available and fruit setting cannot take place. Again, in spring, pollen may be absent from the mature anthers of the stamens for periods of from one to three weeks when wide differences between day and night temperatures are recorded.

Poor pollination during late summer and autumn is mainly due to protracted wet weather, which interferes

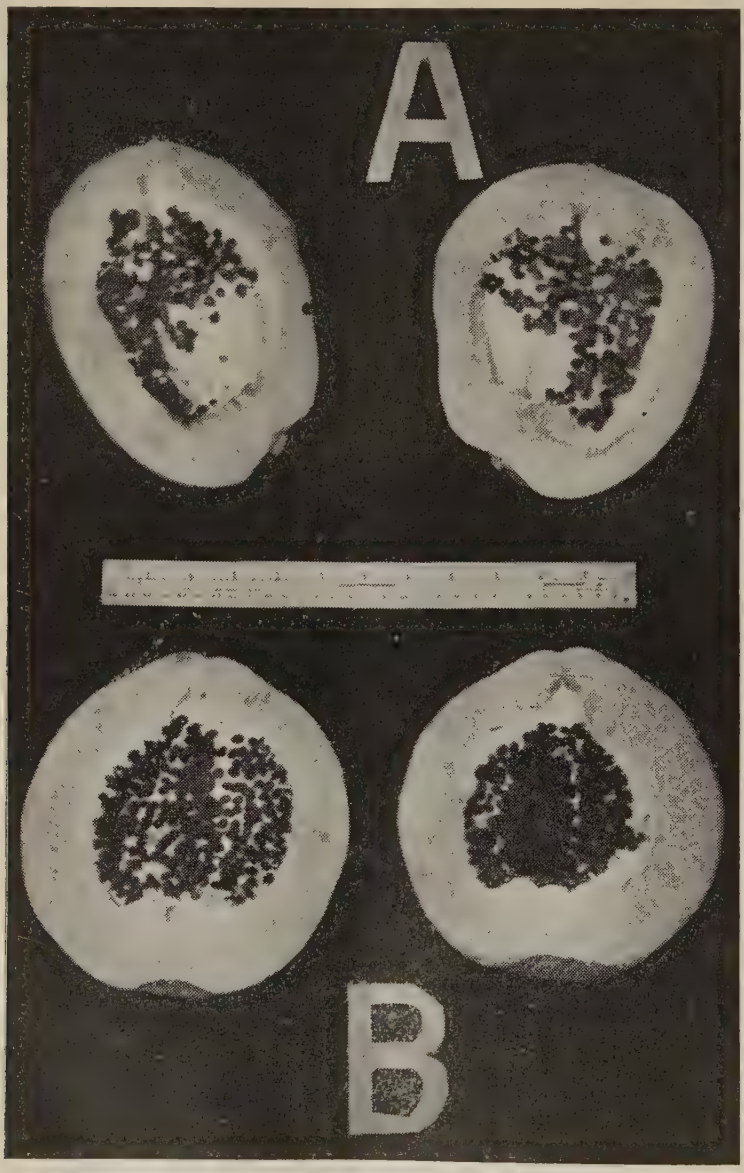

Plate 2.

Effect of Seed Numbers on Fruit Shape and Quality. If the seeds are few or irregularly distributed within the fruit, flesh thickness is variable and shape is uneven.

with the transfer of pollen from plant to plant. In this case the pollen is probably washed from the anthers as they open or is carried to the ground shortly after it becomes air-borne.

When a flower has not been pollinated, the fruit seldom develops beyond the size of a walnut before it gradually loses its green colour, turns yellow and finally falls from the tree. Sometimes unfertilised flowers or partly fertilised flowers do develop fruits but these are either seedless or contain very few seeds. They are generally small, for fruit size is, within the limits set by the strain, determined by the number of seeds; the greater

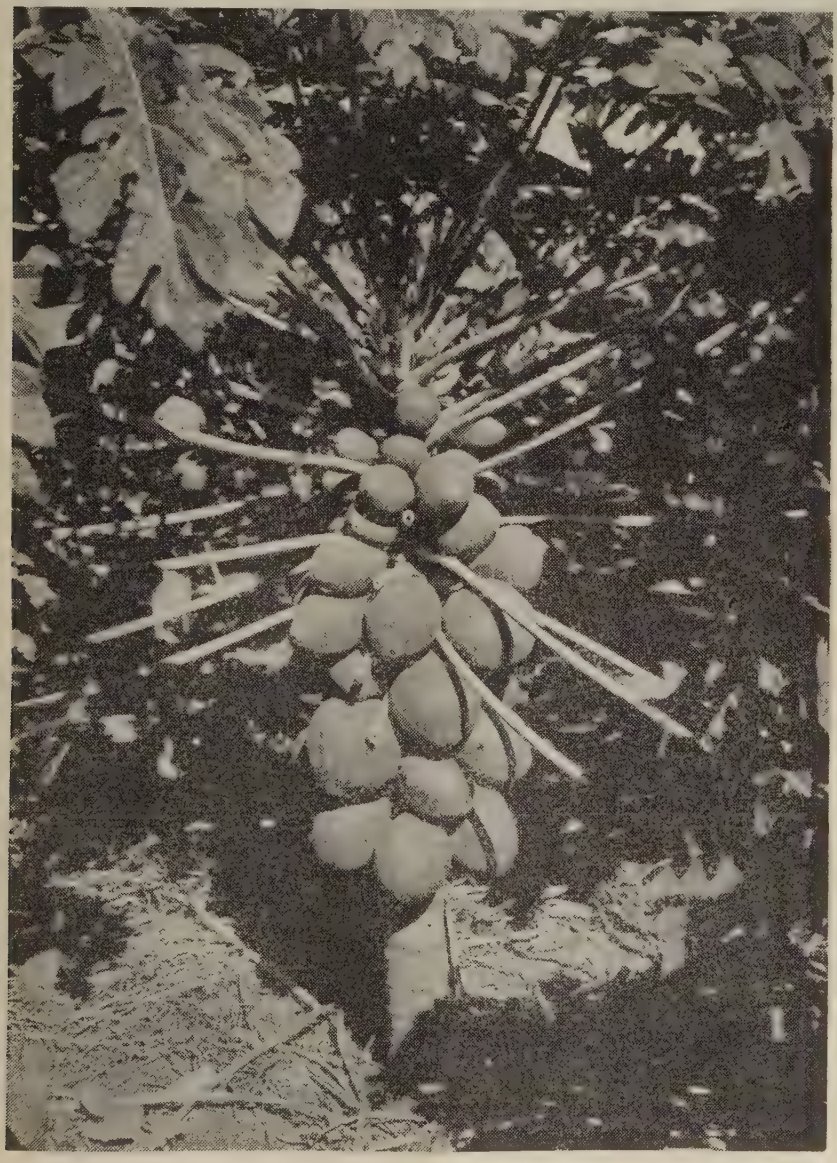

Plate 3.

A Good Strain of Papaw with an Almost Complete Set of Even-shaped Fruit.

the number of seeds, the larger the fruit (Plate 3). The persistence of seedless fruits and fruits with few seeds on the tree is most common on vigorous plants during a good season.

Controlled Pollination.

Faulty cropping due to defective pollination of the flowers can, to some extent, be minimised by hand pollination, which is relatively simple in plantations that are flowering for their first crop. Hand pollination is more difficult in tall trees in which the flowers are less accessible.

Where faulty cropping is due to defects in the variety rather than climatic conditions it is essential to propagate only good strains of a desirable plant type. This involves the pollination of some flowers on selected female trees with pollen from a selected male tree of the same parentage. In hermaphrodite strains, self pollination will meet requirements.

Controlled pollination is not difficult. In the case of female trees a cellophane or other suitable bag is fastened round the flower a day or two before it opens, the bag being slipped over the flower and held in position with a paper clip. When the flower inside the bag opens, a late stage bud from a selected male tree is collected as it is on the point of opening, taken to the mother tree and used as a pollinating brush after the petals are removed to expose the central ring of stamens. After pollination, the bag is immediately replaced in position. Ten to 14 days later, when fruit setting has occurred, the bag is removed and the young fruit is marked so that it can be identified and reserved for seed when it matures.

In hermaphrodite trees, it is unnecessary to transfer pollen; the bag is simply placed over the selected flower before it opens and left in position until fruit set has occurred.

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Nosema Disease of Bees.

By C. ROFF, Adviser in Apiculture.

Since Nosema disease was recorded for the first time in Queensland in one hive at Yeronga during August 1952, other infections have been found in apiaries at Burpengary, Torquay, St. Lucia and Grantham.

This infectious disease of adult honeybees is found in all the principal beekeeping regions of the world. Individual bees and sometimes colonies die from its effects, but rarely is an entire apiary destroyed.

The organism that causes Nosema disease (*Nosema apis*) is a microscopic, single-celled animal parasite (Plate 1), which during one stage of its life history forms resting bodies or spores. The spores after being ingested by the bee germinate within the stomach, and the resultant new parasites invade the cells lining the inner surface of the mid-intestine, where in 3-5 days they mature and produce a further crop of spores. These pass into the rectum and are ejected with the faeces, which some infected bees abnormally void within the hive. Other bees in the same manner contaminate watering places.

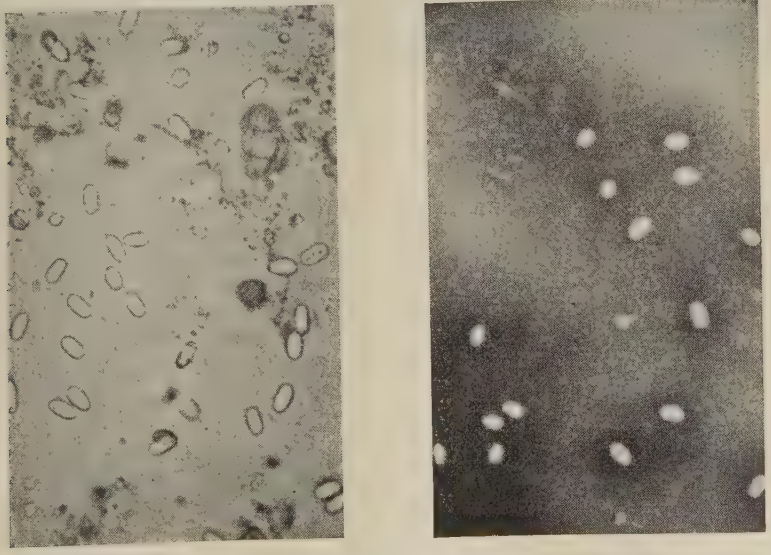


Plate 1.

Spores of Nosema apis in Water (left) and in Stain (right). Magnified 600 times (After Dade).

Transmission of Nosema disease to other bees and to other hives is brought about by the ingestion of water and food contaminated with the droppings of infected bees. Robber bees are also responsible for hive-to-hive infections. Overseas experience indicates that the disease is unlikely to be transmitted by tools, or by the clothes or hands of the beekeeper.

infection subsides during summer, but increases in late autumn and again reaches a peak during the following late winter and spring. At other times, however, the disease may be aggravated by periods of cold, damp weather.

Symptoms.

Positive diagnosis depends upon the presence of spores of *Nosema apis*

Plate 2.

Dead Bees, Infected with Nosema Disease, in Front of a Hive.

Features of Disease.

(1) All races of honeybees appear to be susceptible to Nosema disease.

(2) Workers are most often infected, although occasionally the parasite has been found in drones and queenbees. Brood is not infected.

(3) Nosema is widespread in cold regions, where the bees are confined to the hives during most of the winter. In warmer regions, where bees may fly almost every day in the year, it is found less frequently.

(4) The occurrence of the disease is seasonal. It is most noticeable during late winter and spring. The in the mid-intestine, and this can be ascertained only by microscopic examination. Obvious symptoms are of limited value, as apparently healthy bees may, upon microscopic examination of the stomach, show the presence of spores in large numbers.

Nevertheless, the disease may be suspected if the symptoms described below are present, and specimens should then be submitted for examination. It should be kept in mind, however, that other disorders exhibit similar symptoms, and therefore it does not follow that the trouble is Nosema disease if any or all of the following symptoms are present.

(1) The colony is noticeably restless and weak. Dead and dying adult bees may be noticed in front of the hive (Plate 2), or the colony may dwindle slowly in strength due to steady loss of bees which die inconspicuously away from the hive.

(2) Dysentery may occur and this is evidenced by yellow, crusty faecal spots on the hive floor and alighting board.

(3) Heavily infected bees crawl feebly on the ground and are unable to fly or sting. The abdomen is often distended, shiny and hairless, the wings unhooked and askew, and the legs dragged as if paralysed.

Preventive Measures.

The following measures will minimise the incidence and spread of Nosema disease. If these are adopted as standard beekeeping practice it is unlikely that the Queensland beekeeper will encounter the disease.

(1) The apiary and flight approach of all hives should be kept clean and dry, and colony strength maintained by providing the food, hive space, and protection required for each particular period of the year.

(2) Stagnant watering places (Plate 3) should be eliminated, as these are easily contaminated with spores from infected bees. If running water is not available and containers for water are used, these should be cleaned and recharged regularly, and *always* placed in sunny positions. The spores of *Nosema apis* in water exposed to sunlight are killed in about three days.

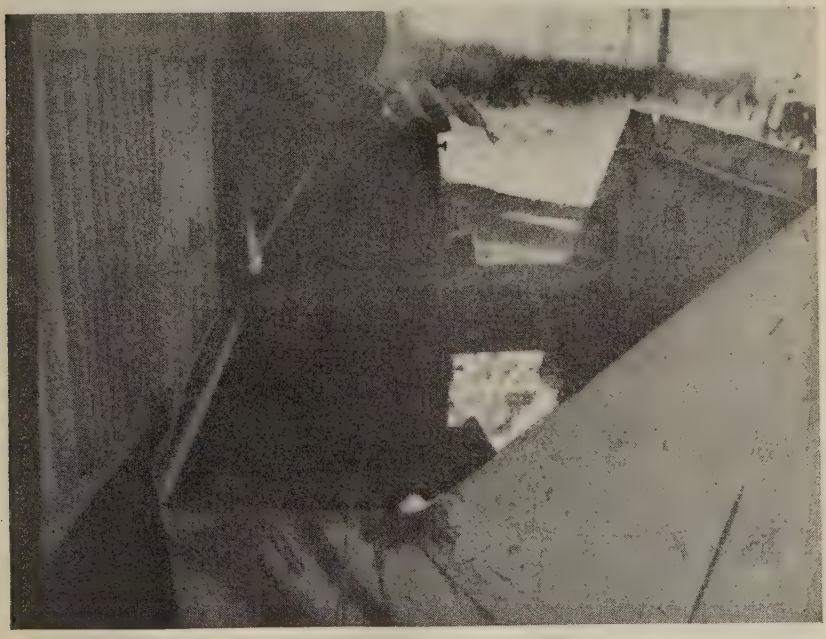


Plate 3.

Watering Places Such as This on the Shaded Southern Side of a Shed are readily Contaminated with Nosema Spores.

(3) Colonies should be kept separated at least six feet apart to prevent drift, and apiaries should be situated where they will obtain full sunlight (Plate 4). Nosema disease is more likely to occur in apiaries situated in shade or partial shade with attendant dampness (Plate 5).

Plate 4.

This Apiary is in a Sunny Position and is Less Likely to Become Infected with Nosema Disease.

Plate 5.

The Hive in this Shady Location Developed Nosema Disease.

(4) Beekeepers should ensure that they do not obtain queenbees, colonies, nuclei, or swarms from an infected apiary. As a precautionary measure, queenbees received from elsewhere in Australia should be transferred on arrival to a clean cage and the escort bees should be replaced by young bees from within the apiary, before introduction to a colony. The old cage, together with any candy it may contain, and the escort bees should be burnt. This procedure is standard quarantine practice for all consignments of queenbees received from overseas.

Treatment of Infected Colonies.

Strong colonies with a mild infection often recover. However, colonies which are weakened seriously by the disease or which die out from its effects should be handled in a manner which ensures eradication, as is described below.

(1) The destruction of diseased colonies should take place in the evening when all bees are in the hives.

(2) Dig a small pit suitable to burn the bees to be destroyed.

(3) Kill all the surviving bees in the diseased hives with calcium cyanide; about two teaspoonfuls of the poisonous powder should be put through the entrance of each hive before closing it. *Extreme care should be taken to avoid inhaling the poisonous gas given off by the cyanide.*

(4) Build a fire in the pit, and as soon as it is burning well, add the bees that have been killed by the calcium cyanide and also any that have died previously from the disease.

(5) Scrape the inside surfaces of the various parts of the hives and burn the debris.

(6) After all diseased material has been burnt, spade the ground down, refill the pit, and pack well.

(7) Render all the beecombs down for wax. The Nosema organism is killed at the temperature of melting beeswax.

(8) Sterilize the contaminated hives, frames, and other hive parts by either boiling for half an hour in 1 per cent. caustic soda solution or scorching all the inner surfaces, edges, and alighting boards to a dark-brown colour with a blow torch.

(9) Turn over the soil beneath and around the infected hives and cover with quicklime.

Legislative Requirements.

Under *The Apiaries Act of* 1947 it is provided that any beekeeper in whose apiary any disease appears shall immediately notify, in writing, the Under Secretary, Department of Agriculture and Stock, Brisbane.

Irrespective of the legal requirements, any beekeeper who notices unusual bee symptoms in his apiary should, for his own sake, communicate with the Department in order that assistance may be given.

Disease Samples.

When sending samples for examination the following requirements should be observed.

(1) At least 20 bees are necessary for diagnosis and these should preferably be alive or recently dead. Dried-up bees are useless.

(2) Mail the sample in a wooden or strong cardboard box. Do not use a tin or glass container.

(3) The package should bear the name and address of the sender and be accompanied by an explanatory letter.

Waters for Stock.

By C. R. von STIEGLITZ, Chemical Laboratory.

From experience gained over a number of years it has been possible to assess the suitability of waters for stock once the composition is known. The following tentative standards are those used in Queensland, but it must be stressed that certain circumstances (such as a very dry climate or the presence of some surface water) may have important bearings on the ultimate decision.

Sheep.

Sheep can drink water containing 1,300 grains per gallon of sodium chloride without harmful effect. When on green feed this limit is quite in order because so little water is drunk. On occasions (for example, with travelling stock) it is advisable to exercise care with waters of high salinity (that is, over 1,000 grains per gallon total soluble solids), as such a water may contain high quantities of calcium and magnesium salts in the form of chlorides and sulphates. If these exceed 150 grains per gallon, scouring will probably occur, and if they exceed 200 grains per gallon deaths are likely. Care is also advocated when sheep are taken from a property with surface water to a bore water high in salt.

Beef Cattle.

Beef cattle by nature of the property usually have long distances to walk in dry times, and so are inclined to take a big fill. A content of 800 grains per gallon total soluble solids is definitely too high in such cases. If possible, total soluble solids should not exceed 600, and if anything like 200 of either magnesium chloride or calcium chloride is present, stock will not readily drink it. At best such a water would be potentially dangerous.

Dairy Cattle.

These should not get over 400 grains per gallon total soluble solids if they are in full milk and the feed is dry. Otherwise the lowered intake of water (because of unpalatability) means lowered milk production. Soluble solids may go to 500 in times of abundant green feed or if adequate silage is fed. Dry cows can use similar waters to those used for beef cattle. For calves the total soluble solids should not exceed 300 grains per gallon.

Horses.

Horses don't often drink water with over 400 grains of soluble solids per gallon. Working horses should not get more than 400, though on green feed 500 for hard work is satisfactory.

Pigs.

Theoretically, pigs should not drink waters with soluble solids in excess of 400, but if some milk is fed and green feed plus a wallow is available, they can stand well over this figure.

Poultry.

Poultry are not supposed to get more than 250 grains per gallon, but they can in practice go over 400 without any harmful effect, particularly layers. The trouble with water containing more than 400 grains per gallon is due usually not to the sodium chloride but to the magnesium and calcium chlorides.

ANIMAL HEALTH

Sawfly Poisoning in Cattle.

By L. L. CALLOW, Assistant Veterinary Officer.

The danger zones for sawfly poisoning are the silver-leaf ironbark areas of the Maranoa and the Upper Burnett.

Poisoning may be avoided by ringbarking the silver-leaf ironbark, at least in sufficient paddocks to enable the stock to be kept off sawfly infested areas.

The depraved appetite which causes stock to eat the sawfly larvae may possibly be due to deficiency of phosphorus or protein in the diet. It is therefore suggested that phosphate and protein supplements be supplied to the cattle.

The poisoning of cattle and sheep from eating the larvae of the sawfly (*Platypsectra interrupta*) is a serious problem in several of the grazing areas of Queensland.

A puzzling feature of this disease is that whilst the sawfly is active almost every year, it is not always that mortalities caused by sawfly poisoning are reported from any one place during a number of consecutive seasons. To quote an instance, sawfly had been active for many years on a property near Eidsvold and no serious effects were noted until 1954, when over 60 head of stock were lost.

Three pounds of larvae will kill a steer but three ounces is sufficient for sheep.

DISTRIBUTION.

The range of the sawfly is fairly extensive and its distribution corresponds to some extent with its principal food tree, the silver-leaf ironbark. Whilst the sawfly is found in many parts of the Commonwealth, the only State in which sawfly poisoning constitutes a problem is Queensland. Until recently, Injune, Roma, Yuleba, Mitchell, Rolleston and Augathella, in the area drained by the headwaters of the Maranoa and Warrego, were regarded as the main problem centres, but in the last few years mortalities in the Mundubbera-Eidsvold-Monto areas have shown the Upper Burnett to be a danger area also.

LIFE HISTORY.

As with most insects, there are four distinct stages in the life history of the sawfly—the adult, the egg, the larva, and the pupa (Plate 1).

The Adult.

The adult is a glossy blue and yellow insect, the thorax being dark-blue above and below, with yellow shoulders, and the abdomen yellow with a series of small blue spots on the sides. The legs are pale yellow except at the base, where they are dark blue. The wings are smoky, with darker veins, and when at rest, folded along the insect's body, they appear black. The female may measure nearly three-quarters of an inch in length, and has black threadlike antennæ in front. The male is smaller and more slender than the female, and may be readily recognised by its feathered antennæ. There is probably only one generation a year, and the adults are to be seen in numbers soon after the summer rains (that is, about February to April).

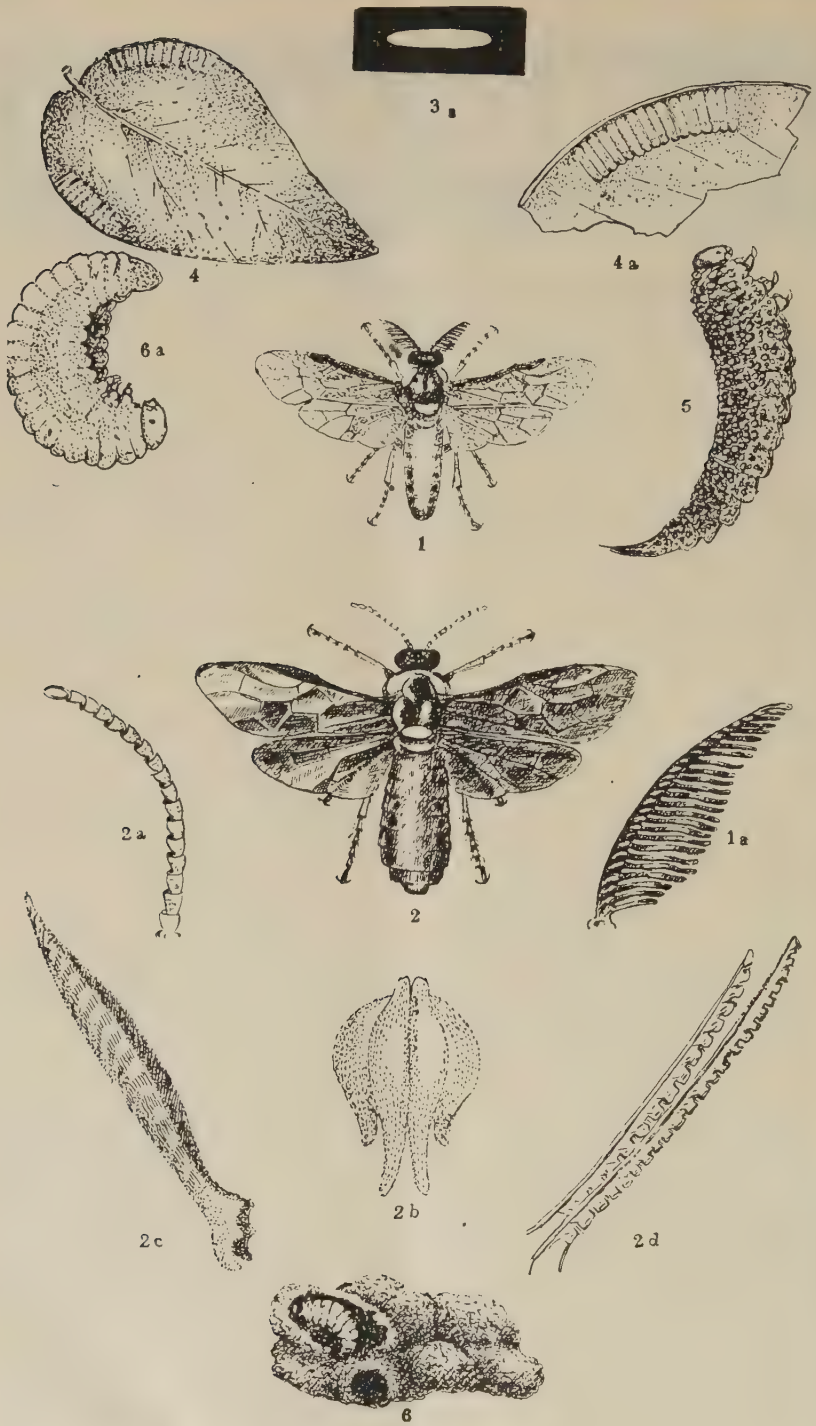


Plate 1.

The Cattle Poisoning Sawfly. 1, Male. 1a, Antenna of male. 2, Female. 2a, Antenna of female. 2b, Groove containing ovipositor, etc. 2c and 2d, Parts of ovipositor. 3, Egg. 4, Ribbon of egg cells in leaf tissue. 4a, Eggs exposed. 5, Larva. 6, Larva in cocoon in sandy soil. 6a, Larva removed from cocoon before pupation.

The life of the adult insects is in all probability very short, and as they are easily susceptible to low temperatures, a cool change may be responsible for the deaths of large numbers.

The Egg.

The eggs are deposited by the females in the leaves of the silver-leaf ironbark, young but well-formed leaves being preferred. When egglaying, the female settles astride a leaf and by using its saw cuts a cleft for each egg in the edge of the leaf. The eggs are laid side by side, and as many as 12 or even more may be deposited on the one leaf. In colour the egg is a delicate pale green, and in shape is somewhat oblong. The incubation period, according to pastoralists, is about three weeks, but dry conditions may delay hatching and if prolonged will kill the egg.

The Larva.

On hatching the tiny larvae move to the edges of the leaf on which they were born and feed on it. This colony formation gradually lessens as the larvae grow; the groups split up, and large larvae may frequently occur singly. In colour the larvae are pale green to yellowish, with reddish-yellow heads, and the body gradually tapers at the rear to a blunt point, which is surmounted by a long, black, spiky appendage. The back is speckled white, the white spots being raised and very conspicuous on the darker front segments.

When disturbed, the individual larvae elevate the hind end of the body, curving the spike in an awe-inspiring manner. They feed voraciously, and a few well-grown specimens will rapidly consume a leaf. Under normal conditions full growth is reached in the late winter and early spring, and in this stage the spike at the rear has been lost. The full-grown larvae descend the trees and pupate.

The Pupa.

Pupation occurs in the soil usually around and close to the trunk of the tree on which the larvae have been feeding. The depth at which pupation takes place is probably dependent to a large extent on the type of soil. In sand, for example, pupae may be found 10 inches or more below the surface.

Once in the ground the larvae construct cocoons from the surrounding earth, gumming the earth particles together to form an oval and compact shell. In the heavier soils the cocoons are bunched together in solid blocks, whilst in sandy soil it is unusual to find any large number of cocoons occurring together, single isolated specimens being frequent. Once the cocoons are formed the larvae pass into the pre-pupal stage, each larva lying shrunken and curved within its earthen home. This stage is thought to occupy most of the period spent below the earth. Eventually the pale greenish pupa is formed, with the wings and other appendages visible and tightly packed against the body.

HOST PLANTS OF THE SAWFLY.

As mentioned before, the sawfly has a definite preference for a certain type of vegetation. Of several species of trees on which the sawfly has been found feeding, it seems that silver-leaf ironbark is the main host for the female sawfly. It is also likely that the fly lays her eggs on narrow-leaf ironbark and black ironbark. Larvae found on trees such as bloodwood, gum-topped box and Moreton Bay ash probably arrive there in the quest for food after having stripped all the ironbarks in the vicinity.

Looking out over infested ridgy ironbark country, brown strips of denuded trees can be seen running for miles. These swathes merge into areas which are still green with eucalyptus leaves either passed over by the female sawfly or carrying eggs ready to release voracious larvae in the very near future.

HOW CATTLE OBTAIN THE LARVAE.

As the leaves are stripped and the food supply is thus reduced, the larvae begin to descend to the ground in huge numbers. It is thought that a temperature effect may also be involved, the larvae becoming progressively more exposed to sunlight as they devour the leaves. Thus, hot weather during the early spring is liable to initiate stock losses as many larvae, unable to with-

Plate 2.

Larvae of the Sawfly.

stand exposure any longer, drop to the ground beneath whilst others manage to crawl down the trunk.

Once on the ground the larvae may crawl to the tree trunk again or else ascend grass, weeds and saplings growing beneath the tree. In the cooler parts of the day, the migration is upward and the larvae are once again seeking food. Thus, there ensues an upward and downward migration of larvae which goes on for at least three weeks and which ends either in pupation or in death from starvation at the foot of the tree.

Should the latter take place, the larvae form a compact heap, generally on the sheltered side of the tree, the size of the heap depending of course on the number of larvae present. For instance, under a large ironbark the mass may measure up to two feet across by about a foot deep. This heap of dead larvae rapidly putrifies into a black, decayed, jelly-like mass which gives off a most objectionable odour.

The very nature of the unpleasant material eaten makes sawfly poisoning a most unusual disease. It is probable that cattle are introduced to the taste of the insect when the grass under infested trees becomes laden with the caterpillars in a season when there is insufficient food for the sawfly population. Once a liking is acquired, the large numbers available at the base of the trunk are investigated and soon cattle are greedily consuming not only live larvae but the black, jelly-like remains. Competition may be high among the animals for this abnormal food and they have been seen to run in mobs from tree to tree fighting and horning in an attempt to obtain more of the material which can in a short time cause their death.

One might ask why cattle often apparently surrounded by feed in abundance develop a craving for such repulsive food. The idea that depraved appetite amongst cattle is due to some dietary deficiency is not new. Our present knowledge lists phosphate deficiency as a major cause of cattle exhibiting depraved appetite, and animals deficient in this mineral can often be seen chewing bones, browsing off trees, chasing pieces of paper and licking the soil along creek banks.

It is felt, however, that other deficiencies may sometimes be involved, such as protein lack. The danger period for sawfly is often before the summer rains, when the pasture is dry and consequently has a very low protein content. It has been shown that sawfly larvae contain over 40 per cent. protein, which could possibly make the caterpillars more attractive for stock. This may be important from a control point of view and is discussed in a later part of this article.

SYMPTOMS AND POST-MORTEM APPEARANCE.

Affected beasts may become highly excited and adopt a high stepping gait similar to that of a blind animal. Other cattle, however, suffer a general and progressive weakness, appearing too depressed to feed. These may linger for some time and present an emaciated, tucked-up appearance, with loss of hair (especially around the head), red nose, and serum discharge from the ears. Those critically affected die in sometimes as short a time as two days. Some survive, but once an animal is down there is little hope of recovery.

Temperatures were taken of two acutely affected cattle in an outbreak in 1954 near Eidsvold. One taken immediately before death gave a reading of 104·8°F. and the other immediately before death was 105°F. Both these temperatures are between two and three degrees above normal. This presents another unusual feature of the disease, as in most poisonings there is little change in body temperature. Post-mortem examinations do not show any particular organic changes which are peculiar to sawfly poisoning. The organ chiefly affected is the liver, where the liver cells are rapidly destroyed by the poison

released by the sawfly larvae. It may become congested with blood, as do other internal organs such as the lungs, gall bladder and abomasum (fourth stomach). All tissues of a young Hereford heifer autopsied by the writer were jaundiced (stained yellow) because of the excessive liver damage. Invariably sawfly larvae or larval heads are found in the digestive tract, the main sites being all four compartments of the stomach. The walls of the fourth stomach are frequently pitted and may tear easily, sometimes before death.

CONTROL.

Treatment of affected cattle in our present state of knowledge is not feasible. Control therefore must be directed to eradication of the sawfly or to removal of the reason for cattle eating the rotting larvae.

Countering the Sawfly.

Control of the sawfly itself is fraught with difficulties and the application of measures which have proved of value in the control of other insect pests does not appear possible.

The destruction of opossums in the sawfly area is said to have brought about the disastrous increase in numbers of sawfly larvae since the beginning of the century. It has been observed that these animals favour the young foliage of the sawfly host tree—the silver-leaf ironbark—and at one time were so numerous as to render the foliage quite scanty. It is known that the opossum destroys the larvae and by its feeding habits limits the chances of the adult female depositing her eggs. An increase in the population of this marsupial would help in reducing the sawfly menace.

Unfortunately, birds do not seem to acquire a taste for the caterpillars and in any case insectivorous ones are by no means plentiful throughout this ironbark country.

Immediately losses from sawfly are experienced the owner should endeavour to shift his cattle to a safe area—that is, a part of the property where there are no ironbarks or where there is no larval infestation. Whilst the destruction of all the silver-leaf ironbark trees by ring-barking may present a practically hopeless task due to the fact that these trees predominate on many large stations, the application of this method of control to smaller holdings has been successful. On the larger runs, the ringbarking of small fenced areas to be held in readiness could be carried out and would be a decided advantage in an emergency.

Treating Deficient Cattle.

1. Phosphorus Deficiency.

There is no reliable evidence that sawfly poisoning is associated with phosphate deficiency, but where such a deficiency exists with associated depraved appetite, the supplying of a supplement would be justified on general grounds.

On properties where a known phosphate deficiency exists the problem should immediately be attacked by the provision of supplements containing this mineral. It is felt that phosphate deficiency in varying degrees is very widespread and that cattle of normal healthy appearance may at certain times suffer from a deficiency which, though not enough to provoke a "deficient appearance," may cause an abnormal appetite to be developed.

Phosphate supplementation can be carried out in two ways.

Licks in covered troughs containing sterilized bone meal and salt in proportions determined by the palatability of the mixture can be provided. The important constituent of such a mixture is the bonemeal, but unfortunately its taste is repugnant to some cattle. The salt is for palatability and the quantity used in the lick is governed by the enthusiasm with which the stock use the mixture. Molasses is useful to increase palatability, but only where licks are being replenished regularly, as it has a tendency to ferment and so spoil the mix-

ture. A suggested ratio for the constitution of the first lick with which the cattle are provided is salt 2, bonemeal 1; this should be changed gradually to salt 1, bonemeal 2, if possible.

An important point is that the lick should be provided at all times except during the wet season in order to ensure a constant normal phosphate status for the beast.

Possibly the ideal method of phosphate supplementation will prove to be by means of an ingenious device invented by a Queensland Stock Inspector. This device is fitted to a pump and adds water in which phosphate has been dissolved from superphosphate at a rate proportionate to the rate at which the pump is pumping drinking water for stock from a bore or dam to a reservoir. The concentration of phosphate to be added to the water is regulated beforehand, according to the needs of the cattle. As can be seen, the chief advantage of this method is that all cattle receive phosphate in approximately equal amounts. This method can only be used where access to water is limited.

2. Protein Lack.

In most of the grazing areas a rapid deterioration of the pastures takes place in April and May, and in an average year the grass is brown and dry for about six months. The protein content of such grass is often as low as 2 per cent., which does little to meet the requirements of the pasture-fed animal.

Starting from when the grass has gone to seed, the provision of a protein concentrate such as meatmeal or linseed meal which, added to the lick, gives a digestible protein content of between 10 per cent. and 15 per cent. in the mixture, may be useful. To achieve this level, 1 part of protein meal should be mixed with 3 parts of bonemeal/salt lick. Once again, some trouble may be encountered with regard to the palatability of the lick and a certain amount of ingenuity and experimentation is needed to induce the stock to take it.

RESEARCH.

Laboratory experiments were conducted at the Animal Research Institute at Yeerongpilly during the sawfly season in 1954. It was shown that the live larvae contain a powerful toxin capable of killing ruminants, and it is hoped by further work with sawfly larvae to ascertain the chemical identity of this toxin. This information can be used to understand the pathological process whereby the beast succumbs to the poison and may eventually lead to the development of an antidote for sawfly poisoning in cattle.

ACKNOWLEDGEMENT.

An article by Dr. F. H. S. Roberts which appeared in the "Queensland Agricultural Journal" in 1932 has been freely used in the preparation of this article.

PAMPHLET ON MILKING GOATS.

A comprehensive pamphlet on the rearing and care of milch goats is available free of charge on application to the Department of Agriculture and Stock, Brisbane.

Brucellosis-Tested Swine Herds (As at 12th August, 1955).

Berkshire.

A. P. and N. Beatty, "Deepdene," Barambah road, Nanango
S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
G. C. Traves, "Wynwood" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, "Kennington" Stud, Underwood road, Eight Mile Plains
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Beau View" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, Middle Creek, Pomona
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, "Burdell," Goovigen
N. F. Cooper, Maidenwell
R. H. Coller, Tallegalla, *via* Rosewood
E. J. Clarke, "Kaloon" Stud, Templin
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
W. F. Ruhle, "Felbrie" Stud, Kalbar
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, "Hartley Grange" Stud, 684 Logan Road, Greenslopes
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. C. Fletcher, "Myola" Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon
The Marsden Home for Boys, Kallangur
M. F. Callaghan, Lower Mount Walker, via Rosewood
J. B. Lotz, M.S. 794, Kalbar
G. J. Hutton, Woodford
E. R. Kimber, Coalstoun Lakes
K. B. Jones, "Cefn" Stud, Pilton
A. J. Potter, "Woodlands," Inglewood
Regional Experiment Station, Hermitage
L. Pick, Mulgeldie
J. W. Bukowski, "Secreto" Stud, Oxley

Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
G. J. Hutton, Woodford
H. L. Larsen, "Oakway," Kingaroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy
F. K. Wright, Narangba, N. C. Line
O. B. Vidler, Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
C. Wharton, "Central Burnett" Stud, Gayndah
S. Jensen, Rosevale, *via* Rosewood
Kruger and Sons, "Greyhurst," Goombungee
V. V. Radel, Coalstoun Lakes
H. R. Stanton, Tansey, *via* Goomeri

Tamworth.

S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
L. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
H.M. State Farm, Numinbah more, *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
H. J. Armstrong, "Alhambra," Crownthorpe, Murgon
Q.A.H.S. and College, Lawes
R. H. Coller, Tallegalla, *via* Rosewood
A. J. Potter, "Woodlands," Inglewood
P. V. Campbell, "Lawn Hill," Lamington

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
J. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
H. Thomas, "Eurara" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trout road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
F. K. Wright, Narangba, N. C. Line
R. A. Collings, "Rutholme" Stud, Waterford
W. R. Dean, "Trelawn," Tandur, *via* Gympie
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank
A. J. Stewart, "Springbrook," Pie Creek road, Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
A. J. Hicks, M.S. 98, Darlington, *via* Beaudesert
Kruger and Sons, "Greyhurst," Goombungee

British Large Black.

H. W. Naumann, "Parkdale" Stud, Kalbar

The Supplementary Feeding of Sheep in Queensland.

Part 5. SUPPLEMENTARY FEEDING IN PRACTICE.

By G. R. MOULE, Director of Sheep Husbandry.

The questions that have to be answered before you commence a programme of supplementary feeding are:—

(1) Which sheep will I feed?
(2) When will I start feeding?
(3) What feeds will I use?
(4) How will I feed them?

Which Sheep to Feed.

There are seldom any difficulties in deciding on the sheep to feed. Obviously you will choose those that are likely to be most productive from both the long-term and the short-term point of view. You may also have to feed a supplement to those sheep that are most likely to be affected by any special deficiencies.

The young sheep are most important from the long-term viewpoint. The way they are fed during the early growing stages of their life influences the way they grow and the weight of wool they will cut during each year of their life. Ewes can be valuable producers of both wool and lambs. Any money spent on rams to keep them in order could quite easily be repaid many times over. Therefore, the weaners and the maiden ewes, ewes that are in lamb or that are lambing, and the rams, are the sheep to give a supplement.

When to Start Feeding.

"Too little too late" is one of the worst mistakes you can make. If you can't move your sheep on to fresh country, it is better to start feeding a supplement as soon as the sheep start to lose condition after the grass has dried off and lost its nutritive value. Even if rain is unlikely for some months, it may be better to start feeding. Doing so could help the sheep maintain their bodily strength and condition and promote wool growth. It can also ensure that more ewes and lambs survive and that a higher proportion of weaners is reared. Above all, it assists the sheep in obtaining the available nutriments from the dry fibrous grass and prevents the sheep from getting weak. This means they are in better order to enter a drought should one develop.

This, in turn, could be of considerable benefit if it were necessary to move the sheep to agistment. It is cheaper to keep sheep strong by giving them a little feed than it is to feed weak sheep until they are strong. It

also enhances their sale value should it become necessary to reduce the flock.

What Feeds to Use.

Three factors will influence the supplementary feed you choose:—

(1) What do the sheep particularly need?

(2) What is available?

(3) What are the comparative costs of the nutriments in the feeds that are available?

There is no point in giving sheep licks or supplements containing large amounts of lime or phosphorus if their diet does not lack these minerals. Similarly, there is no point in giving them energy-rich or vitamin-rich foods if the grass provides enough energy and vitamins.

Lack of protein is usually the first, and it can be the most important, deficiency sheep experience in pastoral Queensland. Therefore, the feeding of protein-rich supplements is always worthy of early consideration. Vitamin A deficiency may also affect rams and weaners some time after the grass becomes dry. At this time the feed may be short of lime too, and this in turn may hinder the development of normal teeth.

Finally, the grass may not supply sufficient energy, so necessary for sheep that have to forage over large paddocks and that have to keep themselves warm as well as carry on the vital functions of breathing and digesting their food.

Even when the feed is green it may contain insufficient copper and cobalt, those two essential minerals that are so necessary for the production of normal red blood cells and the growth of sound, well crimped wool.

These particular requirements will be dealt with later, but in choosing a supplement every effort should be made to provide the sheep with the things they need most.

However, the financial aspects of price and availability of foodstuffs suitable to feed as a supplement have also to be considered.

The foodstuffs available as sheep feed can be divided into two classes: roughages and concentrates.

The roughages include silage and the hays and chaffs. Generally it is uneconomical to feed the roughages unless they are "home-grown". When they are produced on a property they usually provide the cheapest nutriments. The crops from which they were cut may also provide additional grazing at what could be a difficult time of the year, or for a particular line of sheep that need extra nourishment. Where they can be grown and conserved, crops are the best form of insurance against drought, as well as the best fodder to use as a supplement.

The concentrates include the grains and the meals, which are mainly manufacturers' by-products. They are called concentrates because they are far richer in nutriments than the roughages. Concentrates frequently cost a little more to buy than roughages, but when the landed costs are considered in relation to their nutritive content, concentrates provide the cheapest supplements.

The concentrates most readily available in Queensland are maize, grain sorghum, wheat, oats, barley, meatmeal, bloodmeal, linseed meal, cottonseed meal, peanut meal, coconut meal and liver meal. Table 1 summarises the particular attributes of most of these feeds.

Manufacturers' by-products, such as meatmeal, linseed meal, cottonseed meal, peanut meal, liver meal and blood meal, contain more of the things sheep need than do the grains.

For the purpose of drought feeding most of them are of about the same value to the sheep. Oat grain does not contain quite so much nutriment as the other grains, but it has other attributes. All of the grains contain

TABLE 1.

Value of Various Concentrates.

Feed.	Protein Content.	Energy Value.	Mineral Content.	Palatability to Sheep.	Feeding Methods.
Meatmeal	Very high	Very high	Very high	Poor ..	Trough - fed, mixed with some palatable food
Bloodmeal ..	Very high	High ..	Low ..	Poor ..	Trough - fed, mixed with some palatable food
Cottonseed Meal ..	Very high	Very high	High ..	Fair ..	Trough-fed
Peanut Oil Meal ..	Very high	Very high	High ..	Good ..	Trough-fed
Linseed Oil Meal ..	Very high	Very high	High ..	Good ..	Trough-fed
Coconut Oil Meal..	High ..	Very high	High ..	Good ..	Trough-fed
Wheat	Moderate to fair	Very high	Low ..	Very good	Rolled and trough-fed and intake controlled
Oats	Moderate to fair	Very high	Low ..	Very good	Trough-fed
Barley	Moderate to fair	Very high	Low ..	Very good	Trough-fed
Maize	Moderate to fair	Very high	Low ..	Very good	Trough-fed or broadcast
Grain Sorghum ..	Moderate to fair	Very high	Low ..	Good ..	Crushed and trough - fed; intake controlled

insufficient minerals and their value to sheep is enhanced if finely ground limestone is added to them.

For supplementary feeding, however, the manufacturers' by-products have obvious advantages. They are rich in both protein and energy, and most contain adequate minerals. Not all are palatable to sheep, and this can be helpful in actual feeding practice. In supplementary feeding you wish each sheep to get 1 or 2 oz. each day. If they do not relish the supplement offered to them, you have a better chance of restricting their intake once you get them eating.

When you buy fodder for supplementary feeding the cost of the actual nutriment it contains is important. The amount you can afford to pay for each of the foodstuffs most commonly used for supplementary feeding is shown in Table 2.

TABLE 2.

Relative Price Per Pound You Can Pay for Different Fodders to Buy Comparable Amounts of Nutriment.

Foodstuff.	Pence per lb.										
Maize	2·5	2·75	3·0	3·25	3·5	3·75	4·0	4·25	4·5	4·75	5·0
Wheat	2·33	2·57	2·81	3·03	3·26	3·50	3·74	3·97	4·21	4·44	4·68
Barley	2·33	2·57	2·81	3·03	3·26	3·50	3·74	3·97	4·21	4·44	4·68
Sorghum ..	2·21	2·42	2·65	2·86	3·08	3·30	3·54	3·75	3·97	4·18	4·41
Oats	1·83	2·00	2·18	2·35	2·54	2·72	2·91	3·09	3·27	3·46	3·64
Meatmeal ..	2·72	3·00	3·27	3·55	3·81	4·08	4·38	4·63	4·90	5·18	5·45
Bloodmeal ..	2·05	2·25	2·45	2·66	2·86	3·06	3·28	3·48	3·69	3·88	4·08
Cottonseed Meal	2·14	2·35	2·58	2·78	2·98	2·47	3·43	3·65	3·85	4·07	4·28
Linseed Meal ..	2·60	2·86	3·12	3·38	3·63	3·88	4·16	4·42	4·68	4·93	5·19
Peanut Meal ..	2·53	2·78	3·04	3·30	3·54	3·80	4·05	4·31	4·56	4·81	5·08
Coconut Meal ..	2·53	2·78	3·04	3·30	3·54	3·80	4·05	4·31	4·56	4·81	5·08

The vertical columns show the prices that may be paid for other foodstuffs when maize is between 2½d. and 5d. a lb., so that the money outlayed will purchase the same total nutriment.

If maize is 2½d. a lb., then you may pay up to 2.72d. for meatmeal, but only 1.83d. per lb. for oats, and still be purchasing the same number of food units for the same amount of money outlayed.

Before you decide to buy any particular foodstuff, enquire the price of the various foodstuffs from your produce agent. Add on landing charges in the same order as they appear down the side of the table. Place a ruler across the table so you can read off the figures opposite the ruling price of corn. Buy the protein-rich meal the quoted price of which is furthest below the price shown in the table. If all the quoted prices are above those shown in the table, buy maize and the protein-rich meal whose quoted price is least above the price shown in the table.

If one of the energy-rich grains is cheaper than corn, buy it and the protein-rich meal whose quoted price is least above the price shown in Table 2.

In these latter two cases you will have to mix the protein-rich meal with the grain. The proportions in which to do this will be discussed in the next article in this series.

INOCULATION OF LEGUME SEEDS.

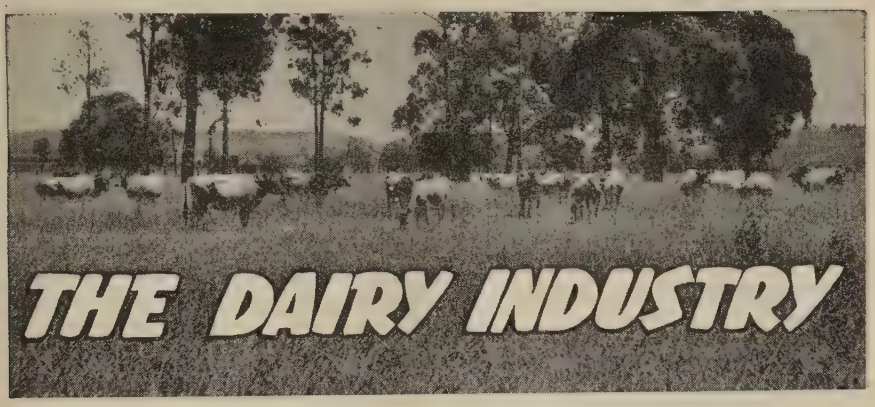
★ ★

The Department of Agriculture and Stock supplies cultures of bacteria for the inoculation of seeds of legumes such as Poona pea, blue lupins, lucerne and clovers.

Seed inoculation is often necessary where the legume intended for planting has not previously been grown successfully, as it provides the plants with bacteria which are necessary for their full development.

Cultures are supplied free and post free. They are in bottles and have to be mixed with skim milk for sprinkling on the seed.

Order from the Under Secretary, Department of Agriculture and Stock, Brisbane, at least 10 days before sowing. State amount and type of seed to be treated.



The Importance of Length of Lactation of Dairy Cows.

By S. E. PEGG, Chief Adviser (Herd Recording).

Since the inception of Group Herd Recording in Queensland, a number of surveys have been conducted and the information obtained from the data collected has thrown a new light on several subjects.

Perhaps the most important revelations have been the short lactation period of many cows and the lowering effect which this has on production.

What should be the length of a satisfactory lactation period? In most of the recognised dairying countries of the world it is accepted as good practice to milk cows for 10 months, allow them to spell for two months and calve them again 12 months after the previous calving.

LENGTH OF LACTATION AND PRODUCTION.

An examination has been made of all completed lactations in the six years since Group Herd Recording was commenced in 1948. This shows that the length of lactation has a big bearing on the production of the animal. Details of the average production for cows with varying lengths of lactation are given in Table 1, and in the diagram shown in Plate 1. The individual lactation records from which this table was prepared totalled 160,528.

TABLE 1.

Effect of Length of Lactation on Production.

Length of Lactation.	Milk.	Butterfat.	No. of Cows.	Percentage of Cows.
Days.	Lb.	Lb.		
30	359	14	2,548	1·6
60	729	30	4,135	2·6
90	1,149	48	6,015	3·7
120	1,628	68	9,086	5·7
150	2,030	92	13,214	8·2
180	2,732	116	19,435	12·1
210	3,336	143	30,072	18·7
240	3,798	165	31,940	19·9
270	4,190	184	28,270	17·6
300	4,556	198	15,813	9·9

The higher production attained by cows with reasonably long lactation periods is evident. During the six years under review, however, only 9.9% (about one-tenth) of the completed lactation periods were for 300 days, although 27.5% were for a period of 270 days (9 months) or longer. One very serious aspect is that, over the period surveyed, 21.8% of the completed lactations were for a period of less than 180 days (6 months).

FINANCIAL LOSSES.

The average length of the lactation period of dairy cows in this State is 210 days and the average production for this length of lactation is 143 lb. butterfat. This amount is 55 lb. less than that produced by cows which completed the full 10 months' lactation period. As 55 lb. of butterfat is equivalent to 67 lb. commercial butter, at the average ruling price of 3/11 per lb. the value is more than £13. Thus, on the average, the dairymen in this State are losing a return of £13 per cow per lactation because of short lactation periods.

According to the Government Statistician's report for 1953-54, there were 914,863 dairy cows, in milk and dry, in Queensland. If the average return for each of these animals could be increased by £13 per year, it would mean an increased return to the dairymen of this State of approximately £11,900,000 per year. This amount is rather staggering, and must cause everyone connected with the dairying industry to give serious contemplation to the losses incurred by short lactation periods.

CAUSES OF SHORT LACTATIONS.

Having shown the serious loss caused by the short average length of lactation of cows in this State, let us examine the causes. In order of importance they appear to be—

(1) Low nutritional standard.

(2) Wrong month of calving.

(3) Infertility.

(4) Uncontrolled matings.

(5) Inheritance.

Low Nutritional Standard.

Most of the dairy herds in this State are dependent on pastures for their food requirements. Pasture is usually supplemented by grazing on cultivated crops, and by the feeding of grain and/or protein concentrates, or fodder conserved as silage or hay.

Under normal seasonal conditions in Queensland there is only a short period during the year when the nutritive value of the pastures is adequate for maintaining a cow's milk production at its inherent capacity. This period is January, February, and March, after which the pasture grasses seed

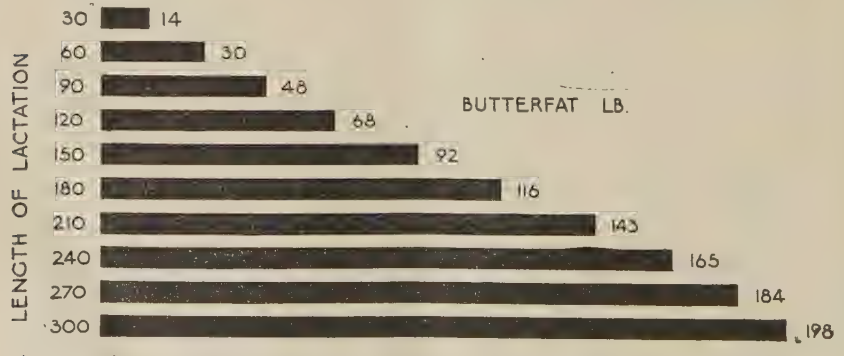


Plate 1.
Effect of Length of Lactation on Production.

and the nutritive value drops rapidly. This peak period of high nutritive value can be extended by pasture management practices, such as strip grazing, rotational grazing and mowing.

It must be remembered that once the grass seeds, not only does the nutritive value drop but so also does the palatability of the pasture. This unpalatability curtails the amount of grass which the cow eats, and as a result she does not obtain sufficient roughage. Therefore, to maintain production, it is necessary to supplement the pasture by grazing on a succession of cultivated crops and/or feeding fodder conserved in the form of hay or silage. The feeding of a supplementary ration of crushed grain and/or protein concentrates in the milking bails can also be practised, but its value is limited unless the animal is obtaining sufficient roughage. Under conditions in Queensland, where an assured rainfall is obtained only in the summer months, the conservation of fodder in the form of silage and/or hay is essential for dairying to be carried out successfully. Fodder conserved in these forms provides a fair amount of nutrients as well as the necessary roughage and can be fed successfully with concentrates as a supplement when necessary.

Month of Calving.

Surveys of herd recording data show that the month of calving has a big effect on the length of lactation and consequently on production. This matter has been dealt with in detail in an article entitled "Seasonal calving for dairy cows" published in the Queensland Agricultural Journal for May, 1955.

Table 2 shows the average length of lactation of cows which calved in the various months of the year. The results are for the whole of the State for the period 1949-54.

TABLE 2.

Effect of Month of Calving on Lactation.

Month.	Days.	No. of Lactations.	Percentage of Lactations.
January ..	193	12,123	7·7
February ..	195	9,299	5·9
March ..	204	8,950	5·7
April ..	216	8,443	5·3
May	224	9,185	5·8
June ..	229	11,344	7·2
July	230	14,269	9·0
August ..	228	16,761	10·6
September ..	219	17,335	11·0
October ..	210	18,945	12·0
November ..	203	17,031	10·8
December ..	195	14,587	9·2

These results are clearly shown by the graph in Plate 2.

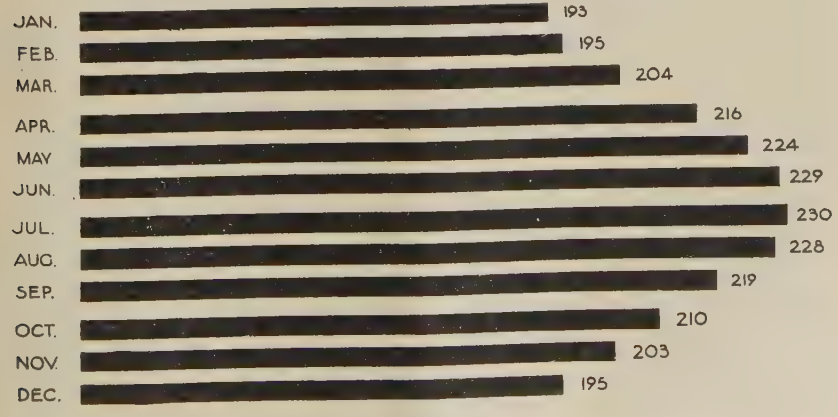


Plate 2.

Effect of Month of Calving on Length of Lactation. (Given in Days.)

It will be seen that cows which calve in the third quarter of the year have the longest lactation period. This period may vary slightly according to districts. Information on this aspect is obtainable from local officers of the Division of Dairying.

Infertility.

Infertility can play a very important part in reducing the length of lactation. If infertility becomes a major problem in a herd, considerable trouble will be experienced in getting cows in calf. In such cases it will be difficult for an owner whose herd is badly affected to arrange to have his cows calve during any desired period.

The keeping of reliable breeding records will enable a herd owner to assess the extent to which his herd is affected by infertility. If there are a number of cows returning to the bull, the owner should seek veterinary advice.

Uncontrolled Matings.

It has been noted that, where the bull runs with the herd, a large number of cows are mated during the first heat period after calving. This means that the cows calve at intervals of about 10 months. This early pregnancy, combined with a low nutritional standard, causes the cow to dry off much earlier than if matings were controlled to allow calvings at intervals of 12 months. Even if they do not dry off of their own accord, it is necessary to dry them off early enough to allow a dry spell of six to eight weeks before re-calving. Unless a cow is given this dry spell before calving, the yield at the subsequent lactation period will be adversely affected.

Bulls should be confined in an adequate bull run and cows mated on the third heat period after calving. Controlled mating is necessary for "seasonal calving" and it also enables a check to be kept on infertility.

Inheritance.

Some strains of dairy cattle which milk for a short lactation period only appear to have inherited this trait. Such strains or families should be eliminated from the herd. When selecting a herd sire, this aspect should be examined carefully.

CONCLUSION.

The short average length of lactation among Queensland dairy cows is a factor in the low average production per cow. The monetary loss involved is serious enough to warrant greater attention being paid to the improvement of husbandry methods, particularly with respect to nutrition and controlled mating.

ENCOURAGING CLOVERS IN PASTURES.

Queensland studies of bacteria which live in the roots of clovers are raising the productivity of the State's dairying pastures in those areas in which clovers can be grown.

This was stated recently by the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.), who said that his Department had been giving much attention to methods of improving the clover content of pastures as a means of raising production.

Certain bacteria known as rhizobia, which live in the roots of clovers and other legumes, provide the plants with nitrogen, but some strains of rhizobia are much more effective than others in this respect.

Mr. Collins said that over the past few years effective strains for the more important clovers had been sorted out by Departmental officers and were available free to farmers for inoculating clover seeds before planting. Sufficient rhizobial cultures to inoculate clover seed for several thousand acres of pastures were supplied during the past year.

Attention is now being given to suitable strains of rhizobia for tropical pasture legumes.

The discovery of effective strains of rhizobia for winter clovers has been a valuable contribution to pasture improvement, said Mr. Collins. When highly effective strains are available for summer pasture legumes, he added, the scope of improved pastures will be widened considerably.

Farm Refrigeration and Market Milk Quality.

By J. CALEY, Dairy Research Branch.

Of 520 direct suppliers to Brisbane milk depots, there are 222 equipped with farm refrigerators. This widespread acceptance of refrigerated cooling reflects the confidence which farmers have in the effectiveness of refrigerators in improving the overall quality of market milk. This desirable trend is in keeping with the rapid development of farm refrigeration in Western Europe, the United Kingdom and U.S.A.—countries which are relatively cooler than Queensland.

In California, U.S.A., the temperature of milk for the market milk trade must not exceed 50°F. on arrival at the factory or depot, thereby necessitating refrigeration on the farm.

The advantages of cooling by refrigeration are several. Without refrigeration, the temperature of milk cannot be brought down low enough to maintain its quality during storage. Satisfactory temperatures are below 50°F., and methods other than refrigeration cannot achieve this temperature under climatic conditions in this State. Refrigerated storage makes once-a-day collection possible instead of twice-a-day collection. A saving of transport is thus effected, and a larger proportion of high-quality milk for the market milk trade is provided. The inclusion of the refrigerated night's milk also ensures milk of more uniform composition in the delivery.

TYPES OF REFRIGERATORS.

Different farm refrigerators have different ways of bringing the temperature of milk to below 50°F., but common to all is the use of refrigerant in a condensing unit. This essential unit disposes of heat removed from milk. The methods of storing the milk also vary. It is important, however, that all milk be shock-cooled over a tubular cooler prior to delivery to the factory or to storage in a refrigerator cabinet.

1. Chilled Water.

Some refrigerators circulate chilled water through a tubular cooler from a tank containing an icebank. The icebank builds up on the expansion coils during several hours' operation of a comparatively small refrigeration unit. This type of unit reduces the initial cost, but limits the amount of milk which can be cooled per day. The limit is reached when the unit has to work practically all the time.

2. Spirit Brine.

Instead of building a reservoir of ice, one type of refrigerator cools a tank of methylated spirits and water. This mixture is used because it can be cooled without freezing to a temperature well below the freezing-point of water. The spirit brine is pumped through the tubular cooler for the precooling of milk prior to storage.

3. Direct Expansion.

The most direct method of cooling milk is to couple the condensing unit to the tubular cooler, which has refrigerant inside. Since the condensing unit keeps pace with the cooling of the milk, the refrigerator can operate continuously at its full capacity. The ability to continue cooling is an advantage, but it carries with it the disadvantage of a large condensing unit at a higher cost.

STORAGE OF MILK.

Cooled milk will rise in temperature unless the temperature is controlled during storage. For this purpose two types of cabinets are available. One permits the cans of milk to be immersed to the neck in chilled water, which also allows for the further cooling of the milk. The water must be kept pure. Unless the water used is soft, treatment may be necessary to avoid rusting of the milk cans. In

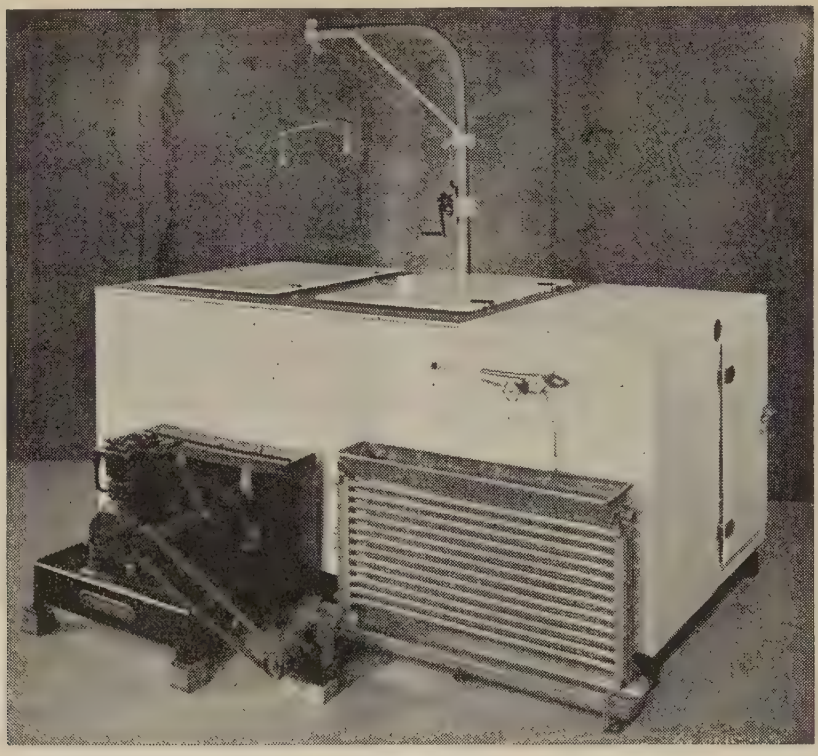


Plate 1.
A Type of Farm Refrigerator for Milk Developed by the Queensland Butter Marketing Board.

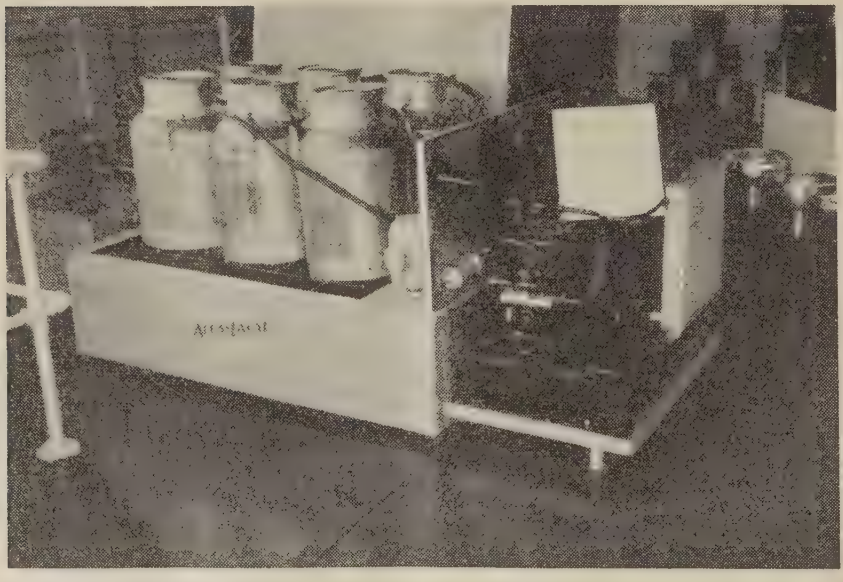


Plate 2.
A Type of Farm Refrigerator Widely Used in Western Europe.

this type of storage cabinet the cans are hoisted into the cabinet with the aid of a hoist.

Other types utilise dry cabinets for the storage of milk, the cans being slid into the cooled storage chamber.

FARM SURVEYS.

To determine the efficiency of farm refrigerators in practice, surveys were carried out on farms near Brisbane. The results show that refrigerators do what is claimed of them. Milk came out of overnight storage with a keeping quality the same as when it went in, provided the milk temperature was below 50°F. This provision is vital. The time elapsing before the milk is cooled to below 50°F. should not exceed one hour from production. Table 1 shows the benefits of cooling milk by refrigeration.

The improved quality of the refrigerated milk is indicated by a 5-hour methylene blue test and extended keeping quality of 24 to 36 hours.

TABLE 1.

THE MODIFIED METHYLENE BLUE TEST AND KEEPING QUALITY AT TIME OF DELIVERY TO DEPOT AFTER OVERNIGHT STORAGE.

Farm.	Refrigerated Milk.		Uncooled Milk.	
	M.B. Test (hrs.).	Keeping Quality (Clot-on-boiling).	M.B. Test (hrs.).	Keeping Quality (Clot-on-boiling).
F	5+	Over 48 hrs.	½	24 hrs.
E	5+	Over 48 hrs.	½	12 hrs.
D	5	48 hrs.	½	12 hrs.

COOLING AND BACTERIAL CONTAMINATION.

The Division of Dairying is gauging the performance of farm refrigerators and the effect of the standard of cleanliness in production on refrigerated milk.

The bacteria in milk multiply very slowly at temperatures below 50°F. They are not destroyed by cooling and multiply rapidly when the temperature rises. It therefore follows that uncleanly produced milk, while not worsening in cold storage, is nevertheless not improved and deteriorates rapidly when the temperature rises.

Tests so far conducted on farm refrigerated milks have shown high counts of thermoduric bacteria. These types of bacteria are heat resistant and have been traced to inadequately cleansed utensils. The numbers present therefore give an indication of the extent to which milk has been contaminated by bacteria from improperly cleansed utensils.

Table 2 shows counts of thermoduric bacteria recorded in *some* refrigerated milks following pasteurisation.

TABLE 2.

PLATE COUNTS OF MILK SAMPLES TAKEN AT FARMS. (BACTERIAL PLATES INCUBATED FOR 2 DAYS AT 32°C.)

Total Plate Count per ml. Raw Milk.	Thermoduric Count per ml.
740,000	680,000
230,000	180,000
190,000	90,000
150,000	150,000
100,000	100,000
90,000	90,000
less than 50,000	less than 50,000

These results indicate the need for observing the strictest standards of dairy hygiene even though milk may be subjected to farm refrigeration. If counts of thermoduric bacteria exceed

50,000 per ml. some fault has obviously arisen in the cleaning and sterilizing procedures.

COST OF COOLING BY REFRIGERATION.

The actual cost of refrigerated cooling depends on a number of factors and can only be accurately assessed in relation to each individual farm. Broadly, however, the cost of cooling may be estimated as follows. A 1 h.p. motor on the condensing unit runs for 8 hours to cool 40 gallons of milk. The cost of power is approximately 2.5d. per unit, or the equivalent of 0.4d. per gallon. To this must be added part of the initial cost of the refrigerator, which ranges from £400 to £500 installed. With approximately 10% for depreciation and 5% interest on capital, the overall cost per gallon of milk is approximately 1.4d.

Direct-expansion refrigerators use half as much power per gallon of milk as other refrigerators, but their initial cost is greater.

For maximum economy it is recommended that the milk be first subjected to atmospheric water cooling through part of a tubular cooler prior to cooling by refrigeration over the lower portion of the cooler.

Whilst the practice of cooling milk by refrigeration is costly, there is no doubt that under the tropical and subtropical conditions experienced in this State, the practice is essential to maintain a high-quality milk for the market milk trade.

Cooling by refrigeration becomes a "must" where milk is stored overnight on the farm and it is pleasing to see that more and more farmers are adopting this wise practice.

1946 . . . 1951 . . . 1956 ?

ARE YOU PREPARED FOR DROUGHT ?

MARKETING

Pumpkin Prices at Auction in Brisbane, 1948-1954.

BY OFFICERS OF THE DIVISION OF MARKETING.

GENERAL CONCLUSIONS.

(1) A fairly definite seasonal price pattern exists for pumpkins but this is masked to some extent by fluctuations and year-to-year variation in the average price level.

(2) There has been a general upward trend in prices since January 1948, the annual increase being approximately 18s. per ton.

(3) This upward trend was merely a sympathetic adjustment in line with changes in general economic conditions up to 1953. During 1953-54, however, the upward trend continued in spite of a general flattening out in the economy, and this was due to a fall in commercial production.

PRODUCTION AND MARKETING.

The production of pumpkins recorded by the Queensland Government Statistician for the six-year period 1948-49 to 1953-54 (Table 1) has averaged approximately 64,600 tons per year, of which the greater portion was grown principally for animal fodder. The quantity recorded as having been grown for sale averaged only 31,550 tons per year, but it seems likely that some of this production would also be used as stock feed, so that the quantity destined for culinary use, with which this analysis is concerned, would normally be much less than half the total annual production.

TABLE 1.

Area and Production of Pumpkins in Main Statistical Divisions.

Statistical Division.	Unit.	1948–49.	1949–50.	1950–51.	1951–52.	1952–53.	1953–54.
Moreton	Acres	11,242	11,723	12,369	13,802	11,893	10,202
	Tons	25,035	26,406	25,107	25,756	26,806	24,086
Maryborough ..	Acres	858	721	643	924	595	314
	Tons	2,189	1,840	1,320	1,724	1,470	701
Rockhampton ..	Acres	801	913	1,146	1,144	1,150	546
	Tons	1,797	2,332	1,937	1,910	2,447	1,193
Townsville	Acres	768	852	898	925	1,335	1,025
	Tons	1,239	1,156	1,208	1,747	2,004	1,864
Rest of State ..	Acres	567	507	549	655	444	325
	Tons	1,431	1,044	964	1,192	763	633
Total State ..	Acres	14,236	14,716	15,605	17,450	15,417	12,412
	Tons	31,691	32,778	30,536	32,329	33,490	28,477

(Source : Queensland Government Statistician.)

The bulk of commercial production for human consumption is located within the Statistical Division of Moreton. In this Division, districts such as the Lockyer, Brisbane, Fassifern and Logan Valleys,

Pine-Redcliffe Shire and Brisbane Metropolitan together provide some 25,000 tons per year, which is about 80 per cent. of the State production for market.

Some fairly well established districts are also to be found in the Maryborough, Rockhampton and Townsville Statistical Divisions. Of these, the more important market suppliers are in the Townsville Division, the main areas being the Burdekin and Herbert River systems and the Bowen Delta country, where easily available irrigation water and frost-free winters enable the crop to be grown successfully out of season.

The principal market centre for pumpkins in Queensland is the daily auction sale conducted by Brisbane Farm Produce Agents at the Roma Street Railway Goods Shed. The quantity passing through this market has averaged about 10,000 tons per year over the last six years. A big percentage of the commercial production bypasses the Roma Street centre, and its distribution is effected by farm produce agents and merchants operating within the various producing districts. In addition, many growers from districts in close proximity to Brisbane, producing about 2,500 tons per annum, tend to market their crop through agents in the Brisbane Wholesale Fruit and Vegetable Markets.

One of the features of pumpkin marketing is the comparatively large volume of interstate exports, the annual average over the five years 1949-50 to 1953-54 being 13,500 tons. Much of this trade is speculatory and during the peak months (August to January) there is usually strong competition between the various distribution agencies to secure supplies.

A summary of total pumpkin production and production for sale recorded by the Government Statistician, together with interstate exports as recorded by the Department of Agriculture and Stock, covering the period 1949-50 to 1953-54 is given in Table 2.

TABLE 2.

PRODUCTION AND INTERSTATE EXPORT OF QUEENSLAND PUMPKINS, 1949–50 TO 1953–54.*

—	1949–50.	1950–51.	1951–52.	1952–53.	1953–54.
	Tons.	Tons.	Tons.	Tons.	Tons.
Total Production ..	72,221	61,937	53,130	69,464	65,858
Production for Sale ..	32,778	30,536	32,329	33,490	28,477
Interstate Exports ..	14,000	15,500	14,000	11,500	10,000

* Year ending March 31.

SEASONAL PATTERN.

The following analysis of pumpkin prices recorded at the Roma Street Auction Sales over the seven years 1948 to 1954 reveals the presence of a fairly definite seasonal pattern. However, this pattern is partly obscured by the severity of short-term fluctuations and it is necessary to examine first the origin and extent of day-to-day variations in order to understand the nature of the seasonal price pattern.

Daily Price Range.

The range of prices recorded on any one day is primarily the result of variations in the quality and presentation of the various consignments offered for sale. So far as presentation is concerned, haphazard grading is perhaps the more important factor affecting realisations. All too frequently, the range of sizes of pumpkins in the sample bag is much wider than it should be and prices obtained for the consignment as a whole are inevitably lower than those obtainable for similar pumpkins correctly graded.

On the score of quality, the most frequent failing is the inclusion of haremarked, sunburnt or damaged pumpkins. Such deficiencies quite often lead to quick deterioration and breakdown and a consignment of otherwise attractive pumpkins can be considerably devalued by the presence of even one faulty pumpkin in the sample displayed for sale. This is particularly important when buyers are seeking supplies for reconsignment to more distant markets.

Another factor tending to widen the daily price range at certain times of the year is the marketing of new season's pumpkins in a somewhat immature condition.

The extent of the price range caused by these factors varies according to the general price level operating and the time likely to elapse before the pumpkins reach the consumer, and on occasions reaches as high as 30 per cent.

Day-to-Day Variations.

Variations in price levels from day to day are caused mainly by changes in supply and/or demand. However, there are one or two important sources of abnormal price variation which should be noted. One instance is that which occurs when a market price is established which is out of line with the normal demand/supply relationship. Such circumstance is generally encountered when a large proportion of receivals has been reserved for particular buyers at "market rates." As the term "market rates" is usually interpreted by the trade to mean the top price obtained at auction, there is a tendency for the price at auction of at least one consignment to reach a level higher than would be obtained under normal conditions. Naturally, the market cannot remain out of equilibrium for very long, and usually returns to normal within a few days.

Episodic events which result in abnormal price variations in the short term include the temporary disruption of supply associated with boggy conditions on the farms, and fluctuations in available road and rail transport facilities. The availability of transport to the south from Brisbane largely governs the extent to which Brisbane speculators are prepared to buy for consignment to the south, and a shortage of such transport can markedly affect demand at Roma Street.

The influence of the numerous factors causing short-term variations has been largely overcome by restricting the analysis to average weekly prices. A good deal of fluctuation is still to be found in the weekly averages, but this fluctuation can generally be explained fairly readily in terms of variations in supply and demand. Moreover, it has been established that despite the sometimes erratic movement of these factors in the short term, they neverthless exhibit a basic movement over the year and this movement gives rise to a definite seasonal pattern.

Supply Factors.

The analysis of recorded data pertaining to receivals of pumpkins at the Roma Street Goods Yard reveals a very definite seasonal supply pattern.

At the outset it should be mentioned that certain aspects of pumpkin marketing are not commonly found in the marketing of most other vegetables, and certainly never to the same degree. The main example is the practice of storing a big percentage of the harvest on the farm. This has the effect of reversing the normal supply/price relationship so that the flow of supplies to the market tends to be regulated by price movements, rather than price movements being caused by changes in supplies. This applies particularly to pumpkins harvested in the main South Queensland districts from March to June, for which the marketing period is extended generally to September and at times well into November.

Details of monthly receivals at the Roma Street Auction Market are set out in Table 3. Reference to that table will show that receivals during January are consistently heavy and generally in excess of totals for other months. This is so because the new season's crop in the Lockyer and adjacent districts is generally well under way by the beginning of January, and as these early harvested pumpkins have a tendency to deteriorate rapidly under the warm humid conditions, they are not held on the farms.

TABLE 3.

MONTHLY RECEIVALS OF PUMPKINS AT ROMA STREET GOODS SHED.

Month.	1948.	1949.	1950.	1951.	1952.	1953.	1954.
	'000 Bags.						
January	7·5	28·8	19·7	15·1	21·9	18·5	21·6
February ..	4·5	14·2	12·0	16·0	16·7	12·0	12·7
March	6·6	12·2	12·2	16·8	12·9	11·4	10·5
April	12·3	10·5	12·4	13·3	9·0	12·9	11·6
May	11·9	7·7	10·0	16·5	7·3	11·6	9·5
June	11·2	10·3	10·6	12·4	7·2	10·3	11·6
July	15·6	9·8	10·9	13·4	9·7	12·7	12·1
August	13·6	18·8	20·9	20·0	10·6	16·5	14·8
September ..	8·3	20·4	22·8	17·8	14·3	18·2	17·6
October	2·7	24·5	9·6	13·2	14·4	18·3	6·4
November ..	3·7	6·3	5·7	3·4	2·8	4·1	10·6
December ..	19·0	12·5	6·0	12·2	13·0	3·6	16·4
Jan.-Dec. ..	116·9	176·0	152·8	170·1	139·8	150·1	155·4

(Source : Division of Marketing.)

Monthly intake for February, March and April is generally moderate, and when related to the average for the 12-months period, slightly below that average. Receivals are somewhat low during May, June and July, but show a substantial rise in August. The pumpkins marketed in August are mostly drawn from stocks held on the farm after harvesting earlier in the year.

Heavy quantities are also marketed in September when held-over stocks are augmented by new season's pumpkins from northern districts and the Pine-Redcliffe areas. October consignments are usually on a par with those of September, but the normal seasonal development

towards the end of October or early in November is an abrupt decline. Generally, November is the month of lightest supply, but in 1948 and 1954 the lowest monthly total was recorded in October.

It should be remembered that meagre supplies on the auction floor at this time of the year do not necessarily mean a general shortage of pumpkins. It merely marks the end of the marketing season for districts in the Lockyer, Brisbane, Fassifern and Logan Valleys. This loss is offset by a shifting of the production scene to the early-maturing districts in the Central Statistical Division and also those in close proximity to Brisbane from which new season's pumpkins are

Fig. 1.

then being marketed. However, supplies from these districts generally find their way to traders by channels other than the auction floor.

In December, early plantings in the Lockyer and associated districts are generally reaching maturity and some increase in auction consignments can be expected.

Demand Factors.

Fluctuations in the volume of demand display strong seasonal characteristics and can be regarded as the major influence on seasonal price movements.

The dominant feature is the strong interstate enquiry which determines the pattern of trading from August to January.

As can be seen from Table 4, the main period of trade with southern markets is from August to January, but some trade also occurs in February and July. In February, the influence of this trade on prices is perhaps less significant than that of supply. However, the volume of demand during July is fairly important, not only because of its influence on price levels but also because to some extent it serves as a pointer to what might be expected by way of interstate enquiry over the ensuing six months.

TABLE 4.

INTERSTATE EXPORTS OF PUMPKINS.

Month.	1949.	1950.	1951.	1952.	1953.	1954.
			Bags.			
January	48,717	33,126	37,301	29,285	12,209	18,514
February	11,046	10,319	20,011	7,101	778	3,519
March	1,032	1,022	8,985	4,968	172	88
April	693	1,518	7,938	746	442	249
May	424	85	4,641	281	404	117
June	2,752	3,207	6,146	1,719	541	400
July	1,053	14,085	11,389	6,028	6,969	17,109
August	21,892	28,563	42,261	20,570	26,779	24,737
September	38,776	35,783	40,221	12,721	31,723	34,345
October	21,153	24,371	26,912	39,067	41,190	31,611
November	58,109	39,966	21,484	48,346	27,807	41,396
December	36,054	33,873	21,349	39,394	43,341	44,366
January–December..	241,691	225,918	248,638	210,406	192,355	216,451

(Source : Department of Agriculture and Stock.)

During the period from March to June, interstate movement in pumpkins is virtually confined to those northern New South Wales centres normally serviced from Brisbane. Generally speaking, demand over these months is restricted and trading in pumpkins is usually very quiet.

Another factor having a seasonal influence on pumpkin prices is the availability or otherwise of potatoes. This influence is seldom very strong but is usually present towards the end of the spring potato crop (late in January and during February) and again late in July and early in August at the close of the autumn potato crop. In practice it has been found that an unseasonal shortage of potatoes, associated perhaps with the failure of one of the above crops, has a

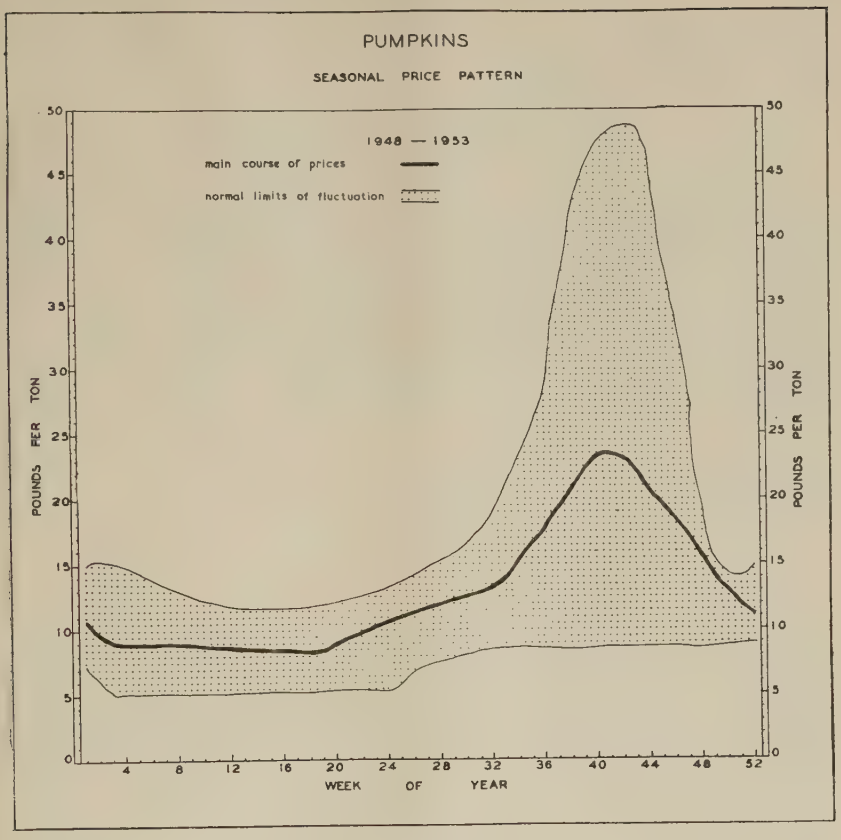

PUMPKINS
SEASONAL PRICE PATTERN
1948 — 1953
main course of prices
normal limits of fluctuation
POUNDS PER TON
WEEK OF YEAR

Fig. 2.

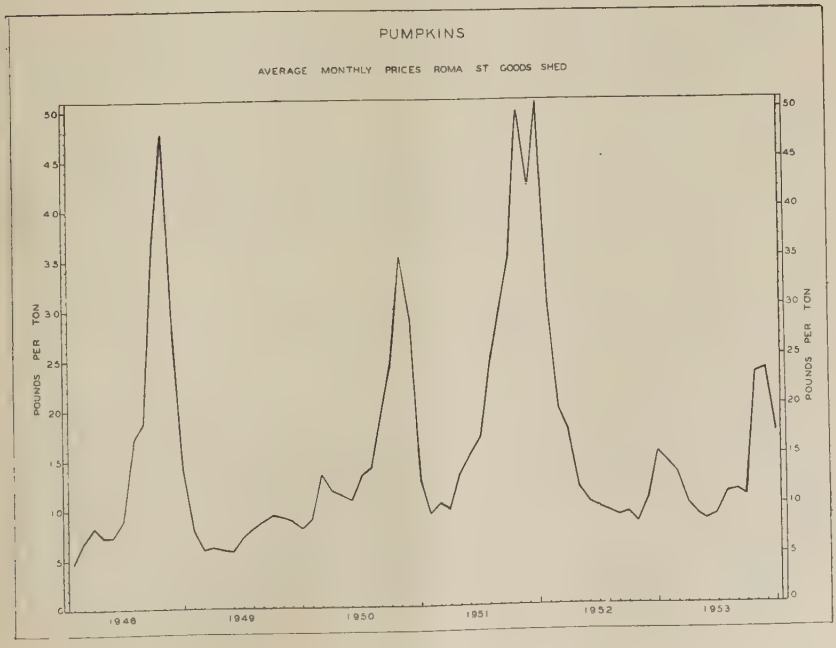

PUMPKINS
AVERAGE MONTHLY PRICES ROMA ST GOODS SHED
POUNDS PER TON
1948
1949
1950
1951
1952
1953

Fig. 3.

stronger influence on pumpkin prices than the normal seasonal influence, but under such circumstances the resulting price movement would be episodic rather than seasonal.

Description of the Seasonal Pattern.

A feature of pumpkin prices is that despite weekly fluctuations and variations from year to year (Fig. 1) there is for the most part a common general pattern. This pattern is given diagrammatic representation in Fig. 2, where it is illustrated as a "main course of prices" located within "normal limits of fluctuation" (see Tables 5 and 6 and Fig. 3). In this analysis the main course of prices represents a mean of annual fluctuations rather than a definite central tendency, and as such has been ascribed definite monetary values. However, these values would not necessarily be valid for any period outside the years under review.

TABLE 5.

AVERAGE MONTHLY PRICES FOR PUMPKINS AT ROMA STREET GOODS SHED, 1948–1953.

Month.	Pounds per ton.		Month.	Pounds per ton.	
	Normal Price Limits.	Average Price.		Normal Price Limits.	Average Price.
January ..	5·5 and 15·0	9·0	July	7·5 and 15·0	11·9
February ..	5·0 and 13·5	9·9	August ..	8·5 and 20·0	13·5
March	5·5 and 12·0	9·2	September ..	8·5 and 33·0	18·1
April	5·0 and 11·5	9·0	October ..	8·5 and 48·5	24·6
May	5·5 and 12·0	8·5	November ..	8·5 and 38·0	20·2
June	6·0 and 13·0	9·6	December ..	8·0 and 15·0	13·5

Basically, the seasonal pattern consists of:—

(1) A period of relatively low but fairly stable prices with a slight downward movement which extends from late January to early May.

(2) A period of about 14 weeks' duration from mid-May to mid-August, when a steady improvement in prices can be expected.

(3) A period extending from mid-August to mid-October (about eight weeks), when prices most frequently follow a sharp upward course.

(4) A period of falling prices covering the period from late October to mid-January to complete the pattern.

(1) The first period from late January to early May embraces the main harvesting period in the major South Queensland producing districts other than coastal and metropolitan. The quantities annually marketed are generally only moderate, but the marketing potential from stored supplies is quite substantial and constitutes an effective barrier to high prices. Moreover, as mentioned earlier, interstate exports fall off considerably early in the period and from March to May are generally too small to exert any upward pressure on pumpkin prices.

TABLE 6.

AVERAGE MONTHLY PRICES OF PUMPKINS AT AUCTION AT ROMA STREET GOODS SHED.

Month.	1948.	1949.	1950.	1951.	1952.	1953.	1954.
	£'s per Ton.]						
January	4·82	7·84	8·95	9·12	30·29	14·20	20·25
February ..	6·87	5·78	13·41	10·40	19·76	13·04	15·24
March	8·34	6·07	11·81	9·86	17·60	10·09	11·05
April	7·44	5·80	11·18	13·31	11·95	8·83	12·76
May	7·25	5·66	10·72	15·17	10·28	8·45	11·97
June	8·97	7·14	13·02	16·90	9·74	8·89	11·37
July	17·17	7·96	13·95	25·00	9·41	11·22	12·54
August	18·55	8·51	19·99	29·84	8·98	11·43	12·76
September ..	37·17	9·29	24·03	35·33	9·15	10·87	14·90
October	47·92	9·01	35·07	49·94	8·12	23·06	32·04
November ..	29·28	8·65	28·95	41·99	10·62	23·57	21·46
December ..	14·05	7·94	12·73	50·75	15·39	17·31	12·33
Jan.-Dec. ..	17·32	7·47	16·98	24·80	13·44	13·41	15·42

(Source : Division of Marketing.)

Another factor tending to keep pumpkin prices at a fairly low level over this period is the relatively good supply of most vegetables. However, it should be remembered that during February, March and April potato stocks are mainly imported from New South Wales, Victoria and Tasmania, and whilst usually sufficient, a temporary shortage is sometimes experienced and is reflected in firmer pumpkin prices.

The month of May is generally the slackest time of the year for pumpkins. Interstate exports are usually at their lowest, and for the first two weeks at least consumer interest is generally concentrated upon new season's potatoes from the local autumn crop. At the same time, pumpkin consignments are below average in both quality and quantity, as growers tend to hold their more attractive pumpkins in anticipation of higher prices towards the end of the season.

(2) The second period covers practically the remainder of the marketing season for Brisbane's hinterland crops. The main feature is a general improvement in prices, initiated no doubt by a gradual recovery in the volume of interstate trade in pumpkins. Other contributory factors are the diminishing supply of potatoes and a slight improvement in local demand.

3) The strong upward movement which develops during August and reaches a peak about October is the dominant feature of the seasonal pattern. Undoubtedly, the strength of this movement is determined mainly by the heavy volume of interstate transactions. During August and September, consignments to the Roma Street Auction consist mainly of pumpkins which have been stored on the farms and these are augmented by new season's consignments from northern districts. Those consignments of a quality suitable for interstate trade usually attract good competition from buyers. A pointer to the increasing volume of this trade during September is given by the fact that new seasons's pumpkins from the Redcliffe district are generally absorbed without any retarding effect on the rising price level.

There is a slight change in some factors during October, when interstate transactions generally slacken. This development reflects more the difficulty in getting sufficient supplies of the required standard of quality than a reduction in potential demand. In any case, demand remains at a high level; it might even rise, since local enquiry sometimes improves, as the potato supply position is liable to be erratic, depending upon the frequency of shipments from Tasmania.

(4) The fourth period, from late October to mid-January, is one of falling prices, a movement which is caused mainly by a weakening of those factors which produced the previous rise in prices.

The various factors do not all lose strength simultaneously—in fact, November usually marks the peak of interstate pumpkin exports. Despite the fact that prices are falling sharply, the average level for the month is still high. So far as consignments to the Roma Street Auction are concerned, November is the month of lightest supply. However, as mentioned earlier, this is not indicative of the overall supply position, since that market is bypassed by substantial quantities of new season's pumpkins destined for wholesale centres in New South Wales and Victoria. In most instances, an easing in Brisbane prices at this time is a reflection of price movements in the interstate markets. At the same time, a further minor cause may arise from the fact that by mid-November harvesting of the South Queensland autumn potato crop is well under way and this would tend to reduce local demand for pumpkins.

During December and January, the volume of interstate exports is fairly high but is nevertheless decreasing. On the other hand, pumpkin supplies are increasing rapidly and these developments are accompanied by a corresponding fall in prices.

In the foregoing discussion the general outline of the seasonal pattern has been considered without reference to the normal limits which operated over the years 1948 to 1953. Nevertheless, the pattern so established may be considered as the basic seasonal movement and as such will, in normal times, always be inherent in pumpkin prices. However, its practical application as a guide to future price levels should be only as a rough indicator—its main value is in understanding the various forces which affect them.

With regard to the actual limits, reference to the diagram of seasonal price pattern will show that from January to early August the normal limits of fluctuation are reasonably close, and the line depicting the main course of prices may possibly be taken to represent a central tendency over the years concerned. However, from September to early December the limits within which prices normally lie are very wide and no definite central tendency can be established. Over this period the line showing the main course of prices more or less represents a mean between divergent price levels.

In practice, then, application of the seasonal pattern outlined above would involve consideration of both the main course of prices and the normal range of variation. Also, since these have been expressed in absolute terms, some adjustment for trend increment would be necessary. This is discussed later.

Variations from the Seasonal Pattern.

The nature of the seasonal pattern of pumpkin prices is one of variation within normal limits which provide for a fair degree of fluctuation. Naturally there have been occasions when fluctuations have exceeded the normal limits without actually deviating very far from the general pattern described.

Examples of such variation include the very high spring peaks reached in 1948 and 1951. These were both caused by abnormally dry conditions which reduced the yields from the main autumn harvest and the local spring crop, and at the same time set back the harvesting period of the latter crop. In fact, conditions were so bad in 1951 that peak prices were recorded for practically all vegetables and high levels were maintained throughout most of the summer months.

A similar variation from normal was associated with the October peak in 1950. In that month receivals fell to 9,600 bags, compared with 22,800 bags in September. Excessive rain in June and July induced earlier marketing of a big percentage of the held-over stocks, and only small quantities were available for October. At the same time, dry windy conditions over the late winter and early spring delayed the maturity of the local pumpkin crops. An additional high price influence was provided by the partial failure of other vegetable crops in local districts.

As well as the disturbances outlined above, two major departures from the general seasonal pattern were noted. These involved the maintenance of a relatively low level of prices in 1949 and 1952 over the September-November period, when prices are normally high. In 1949, the reason for the low prices was apparently that many growers withheld greater quantities than usual for marketing in that period—in fact the combined total of 45,000 bags in September and October 1949 has not been exceeded in the last seven years. An additional factor, and one which was common to both 1949 and 1952, was the reaction to low ruling prices in southern markets.

TREND.

Trend analysis of pumpkin prices over the seven years 1948 to 1954 has been somewhat difficult because during those years the pumpkin market has been subject to a high degree of fluctuation which has varied both in time of occurrence and in magnitude. Nevertheless, some fairly useful conclusions have resulted from the analysis and these are summarised below.

Over the whole period there has been a general increase in basic prices of approximately £6 6s. per ton, which is equivalent to an increment of about 18s. per ton per year.

From 1948 to 1953, this increment represents a basic increase in pumpkin prices consistent with a steady upward trend, but the increase in 1954 is thought to be due at least in part to lower production.

Generally speaking, there has been little fluctuation in total annual production over the period, except in 1953-54. Between 1949-50 and 1952-53 production was always between 30,000 and 33,500 tons, but it fell to 28,477 tons in 1953-54. The evidence suggests that the increase

in price levels in 1953-54 was in some measure caused by the lesser quantity of pumpkins available, and was not therefore merely a continuation of the earlier basic trend.

Support is given to this conclusion by the fact that the basic cause of the upward trend during the earlier years was a steady improvement in demand combined with the inflationary tendencies of the period, and the influence of the latter factor has not been so great over the last year or so.

There is good reason to believe that the earlier trend has given way to a new trend with a smaller annual increment, but the data available at present are hardly sufficient to give a reliable measure of any new development.

It has been mentioned earlier in this analysis that the seasonal pattern may be used in conjunction with trend correction to arrive at some indication of the course of prices in the near future. Under normal circumstances, prices in 1955 should follow the same general pattern outlined earlier, but at a level which is, on the average, slightly higher than that depicted on the chart of seasonal price pattern.

Once again, it is stressed that only a rough guide is provided, since the periodicity of the many variations cannot be anticipated and at the same time it is not known just what allowance should be made for future trend.

BOOK REVIEW.

"The Romance of the Australian Land Industries." By R. D. Watt.

This is an historical review of the development of the rural industries of Australia, full of interest to all connected with primary production or alive to its place in the national economy.

Emeritus Professor Watt has drawn on a tremendous amount of authentic material and has arranged his selection of facts in a most readable manner. He tells a fascinating story of early settlement, the spread of agriculture, dairying and stock-raising throughout the Commonwealth, and the complexity of modern agriculture.

Though prominence has been given to scientific research and its applications—as would be expected of one who taught hundreds of agricultural scientists at the University of Sydney—the long-bow has not been drawn, except perhaps in including the discovery of the vector of bunchy-top of bananas and the application of control measures among the "miracles of modern science."

Through the eyes of experience, the author sees that "The ultimate progress in rural development must come from the man on the land himself, who has done such wonderful work in the 163 years of our short history, and it is only right that he should have all the assistance which agricultural education and research can give, especially as his success benefits, directly or indirectly, every member of the community."

The book is available from booksellers for 30s.